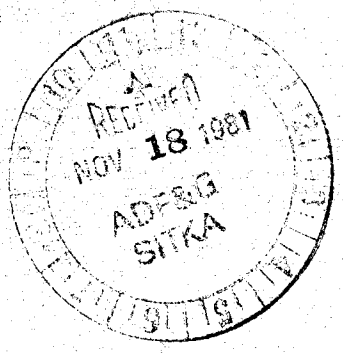
DANIEL M. BISHOP

Environaid

12175 Mendenhall Loop Road
JUNEAU, ALASKA 99801
907 789-9305



An Interim Report on

Biological- Ecological Work

on the Black Bear Creek System

Prepared for:

Harza Engineering Company
Chicago, Illinois

November 2, 1981

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I. INTRODUCTION

The environmental work outlined in this interim report is a part of feasibility studies for the proposed Black Bear Lake hydropower installation. This work is a continuation of studies in 1980 measuring or describing water quality, stream flow regime and habitats found instream and on adjacent valley bottom lands, as well as spring 1981 trapping of outmigrating fry from Black Bear Creek.

Work carried out in summer and fall, 1981, focuses primarily on the upper portion of the Black Bear Creek drainage, i.e., Black Lake and its primary inflowing streams which provide salmonid spawning and rearing habitats. It is this part of the Black Bear Creek system which is most likely to be affected by installation and operation of the hydroelectric facility.

A field camp was established on the southwest shore of Black Lake on 31 July 1981. From this base intensified biologic and hydrologic investigations were carried out. Visits were made to Black Bear Lake to make lake profile measurements, to make plankton hauls, and to service a thermograph installation, but detailed investigations of the fish population in Black Bear has been deferred until spring 1982. The field camp was broken on October 24 after a final round of adult coho salmon counts, stream flow measurements, and servicing of thermographs.

II. ACCOMPLISHMENTS

Work was done in three distinctive areas: Black Bear Lake, Black Lake, and Black Bear Creek tributaries above Black Lake. These efforts are summarized below.

Black Bear Lake

Monthly measurements of temperature, conductivity, and dissolved oxygen were made in two vertical sections located in the two opposite ends of the lake. The continuous thermograph was maintained. Plankton hauls

were made during the August visit, and a casual hook-line sampling was made of resident fish population. Incidental observations were made of lake level and air temperature at times of visit.

Black Lake

A staff gage was installed near the downstream end of the lake. This gage was read daily during camp operations. Weekly flow measurements were made near the outlet of Black Lake. These flows were related to readings of lake stage. A buoyed sampling station was established at the deepest (40 feet) point of the lake. Monthly temperature, conductivity and dissolved oxygen profile measurements were made at the sampling station. Zooplankton and phytoplankton hauls were made. Benthic invertebrate sampling was carried out. Population estimates of rearing salmonids were made using minnow traps. This work did not include sockeye juveniles, since these fish are not susceptible to trapping of this nature. Mapping of the lake was undertaken, including a description of the littoral zone. A rain gage was maintained daily during camp operations.

Black Bear Creek Tributaries Above Black Lake

A stadia traverse was made of the stream system which provides salmonid habitats for spawning and rearing. This work did not include the South Fork stream channels above their confluence with the main channel. A map was made from this work (Map 1), and detailed additional notes, corrections and habitat descriptive information were added to the draft map. Detailed additions to the map will be incorporated in the final (1982) product. Stations were established for weekly flow measurements of (a) stream system draining Black Bear Lake, and (b) stream draining South Fork. Measurements were continued during periods of camp operations. These two stations are located in a section of the stream which is unstable in character, and without suitable "control" to allow meaningful use of staff gages. Regular escapement counts were made of adult salmonids from August 5 through September 16 and October 21 through October 24. Population estimates of juvenile rearing salmonids were made in three homogenous sections of the stream and in the associated beaver ponds. Mammal uses of the area above Black Bear Lake were observed and recorded. Periodic specific observations of beaver activity were made,

Map 1: Black Bear Creek Above Black Lake

(see map pocket)

and a reconnaissance of bear routes in the valley above Black Lake was completed. An extensive characterization of the stream was completed. This included bank stability and type, aquatic and streambank vegetation, stream canopy, substrate character, flow regime, and extent of fallen log debris.

III. RESULTS

Although a comprehensive evaluation of the stream system under study must await completion of analyses of samples and measurements taken this field season as well as results from next spring's work, a considerable body of information is now available. This information can be grouped into four headings:

A. Characterization of flow regime and water quality;

B. Adult escapement into the stream system above Black Lake;

C. Resident juvenile salmonid populations in Black Lake and upstream waters;

D. Observations of mammal populations above Black Lake.

These interim results represent the body of this report. A thorough integration of physical and biological conditions and effects will be made at the time of the final report in 1982.

A. Characterization of Flow Regime and Water Quality

Physical aspects of the upper Black Bear Creek system considered in summer-fall, 1981, included:

1. Location and description of the Black Bear Creek watershed above Black Lake;

2. Comparative streamflow measurements at and above Black Lake;

3. Continuing lake profile measurements of temperature,

conductivity and dissolved oxygen in Black Lake and Black Bear Lake;

4. Continuing water temperature measurements plus installation of a fifth thermograph buried in streambed gravels above Black Lake.

This interim report summarizes physical information available as of the end of October in terms relevant to biologic observations and to design and operation of the hydroelectric facility.

1. Four principal channel conditions have been identified between Black Lake and the base of the falls below Black Bear Lake. These are described consecutively, moving upstream. The first three are shown on Map 1.

   a. Immediately above Black Lake begins about 3,000 feet of streambed with sustained, slow-moving water in a channel about 50-75 feet wide. The stream loses about 1.3 feet in this section: approximately 4/10 of 1% gradient. Occassional logs and windfalls provide stream controls as well as favorable resident fish habitat. Pools range up to 6-8 feet deep, even on low water, and streambanks are generally vertical, often over-hanging, and reach 4-6 feet above the streambed. The streambed is predominantly sand/silt. In one or two locations angular rocks, some of cobble or boulder size, are found on the streambed. The origin of this material is unclear.

      Stream edges are thickly grown with Devils club, salmonberry and high-bush cranberry. Dispersed, open-grown Sitka spruce 80-100 feet tall are common along the stream.

   b. Above the slow-moving stream, there is a section roughly 300 feet long to the primary forks separating the South tributary from the Black Bear Lake system. This channel, generally about 35-50 feet wide, has an overall gradient of

nearly 1% which is controlled by numerous log barriers and drops across the stream.

The streambed gravels in this section are not coarse, and are uniformly iron-stained, clearly indicating the emergence of poorly aerated ground water with a dissolved iron load. The fifth recording thermograph is buried in the streambed in this section.

Streambanks extend 2-4 feet above the streambottom, ranging from overhanging and vertical to gradual bars of gravel. The stream channel is vulnerable to radical changes due to flood flows.

c. Beyond the forks of the South tributary and the Black Bear Lake system, mapping of the latter system continued to beyond the limits of spawning. The approximate lengths of these channels (either Spring Fork or Lake Fork) providing spawning habitat is about 700 feet and the channel width about 25-35 feet.

The gradients of these channels are about 1%+ overall, although beaver dams have major effects on gradient conditions in the lower Lake Fork. On higher flows the beaver dams are crested by flows and upstream migration into the limits of spawning in Lake Fork is unimpaired.

Iron-staining in the coarser gravel-cobble bed materials of these channels becomes less frequent moving upstream and is not found in upstream reaches. Lack of iron staining is particularly evident in source areas of these streams. In these areas upwelling spring flows of variable volume and temperature occur. We believe these concentrated spring areas are fed by near-surface flows through the voids of boulders and rubble, which provide a rapid flowing conduit from the streambed below the falls. In this way, these waters do not pick up much iron from groundwater sources

and do not have as much time in groundwater flow to have much tempering of water temperatures. Hence, it may be that these springflows are more variable in volume, constancy and temperature than the iron staining upwelling flows that probably feed through the beds downstream.

The South tributary was not mapped. Gradient conditions on the spawnable portion of this stream above the forks (also about 700 feet in length) may be somewhat higher. It is also possible that some of the flow in the South tributary is fed by observed springs just before the tributary turns south into the steepening slope. However, these spring flows are small in volume and extent.

d. Above the limits of habitat, and beyond the channels seen in Map 1, is the intermittently flowing channel(s) originating below the falls. This channel system, including abandoned channels and flood routes, is built of large, angular rubble and boulder material. During conditions of continuous flow below the falls, the stream is a cascading rapids, while during periods of receding low flow the stream loses its flow into the bed and will become intermittent and then dry if the dry period continues. The latter condition undoubtedly occurs during both summer and winter dry (or extended cold) periods.

2. Comparative streamflow measurements at and below Black Lake.

Measured flows are summarized in Table 1 and are displayed graphically with rainfall and lake level data in Figures 1, 2 and 3. Note that data needed on the flows from Black Bear Lake is not yet available.

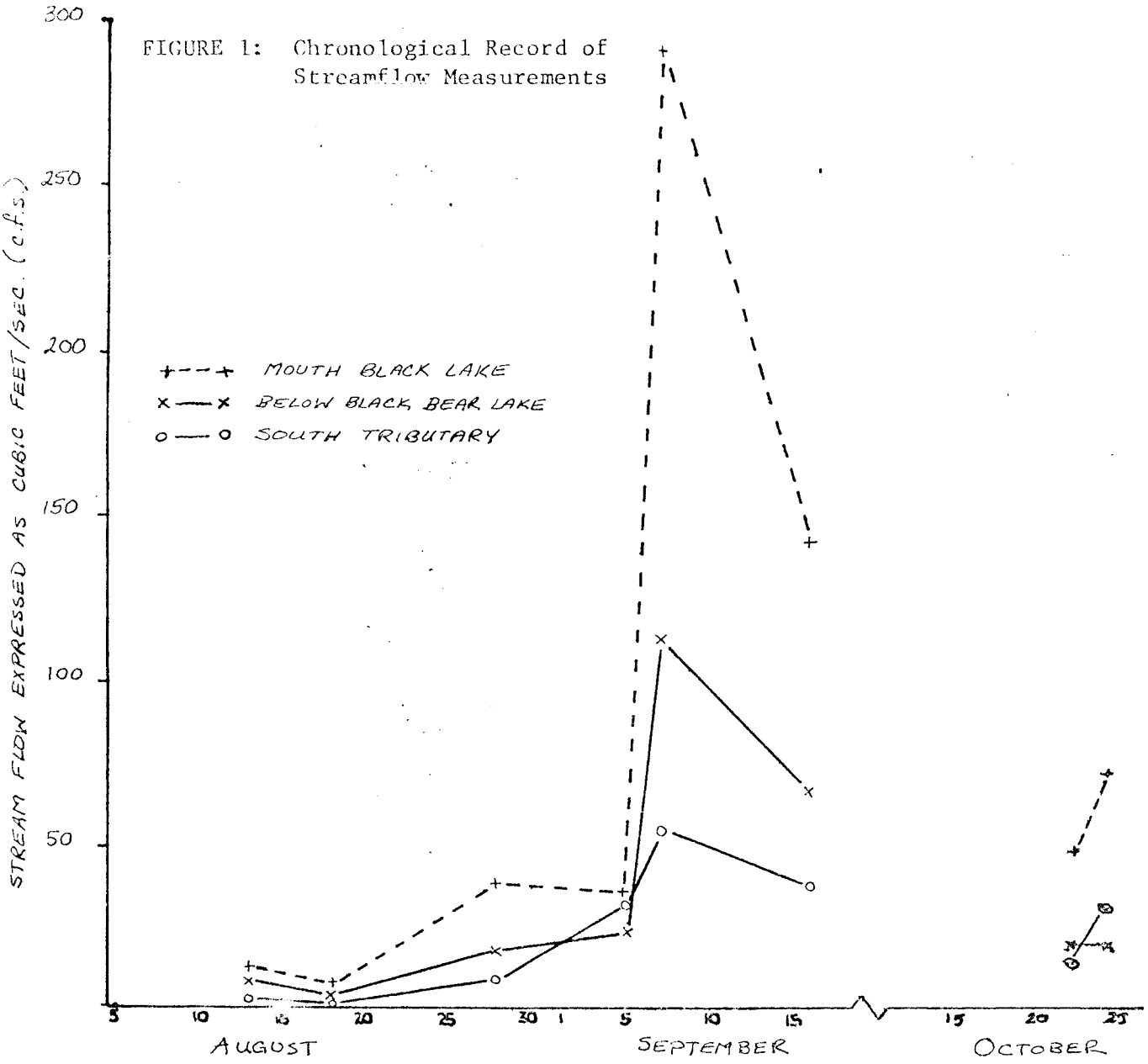
Figure 1 provides a plotted, chronologic record of streamflow measurements taken at the respective stream stations. It should be borne in mind that peaks and lows shown in this plotting represent only values measured at a point in time, and are not

TABLE 1: Tabulation of Streamflow Measurements, Black Bear Creek; August 13 through October 24, 1981.

Date	1/ 2/ Black Bear Lake (USGS)	3/ Below Black Bear Lake System	4/ South Tributary	5/ Mouth, Black Lake
8-13		(ca. 9 AM) 7.79 cfs [2.33 C.S.M.]	(ca. 10 AM) 3.25 cfs [1.48 C.S.M.]	(ca. 3 PM) 12.38 cfs [1.69 C.S.M.]
8-18		(ca. 1 PM) 4.29 [1.28]	(ca. 2 PM) 1.72 [.78]	(ca. 4 PM) 7.20 [.98]
8-28		(ca. 9 AM) 18.38 [5.50]	(ca. 10 AM) 9.89 [4.50]	(ca. 3 PM) 39.51 [5.38]
9-5		(ca. 9 AM) 24.2 [7.25]	(ca. 10 AM) 32.07 [14.58]	(ca. 3 PM) 34.64 [4.72]
9-7		(ca. 8 AM) 112.53 [33.69]	(ca. 9 AM) 54.64 [24.84]	(ca. 1 PM) 291.26 [39.68]
9-16		(ca. 9 AM) 65.96 [19.75]	(ca. 10 AM) 27.16 (16.89]	(ca. 3 PM) 143.75 [19.58]
10-22		(ca. 10 AM) 19.52 [5.84]	(ca. 11 AM) 13.28 [6.04]	(ca. 2 PM) 47.54 [6.48]
10-24		(ca. 9 AM) 19.29 [5.78]	(ca. 10 AM) 29.36 [13.34]	(ca. 2 PM) 70.54 [9.61]

1/ Data not yet available from USGS.
2/ Drainage area = 1.92 square miles. Flow measured at mouth, Black Bear Lake.
3/ Drainage area = 3.34 square miles. Measured 3/4 mi. below Black Bear Lake.
4/ Drainage area = 2.20 square miles. Measured near (3/) where tributaries meet.
5/ Drainage area = 7.34 square miles. Measured immediately below Black Lake.

FIGURE 1: Chronological Record of Streamflow Measurements



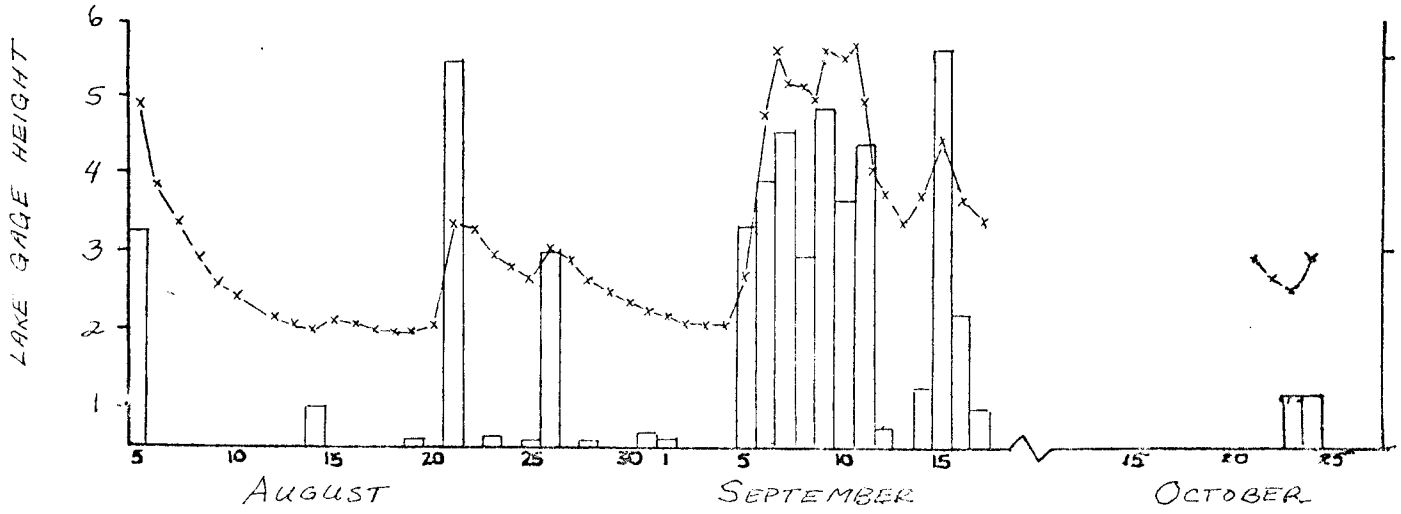


FIGURE 2: Chronological Record of Black Lake Level and of Rainfall

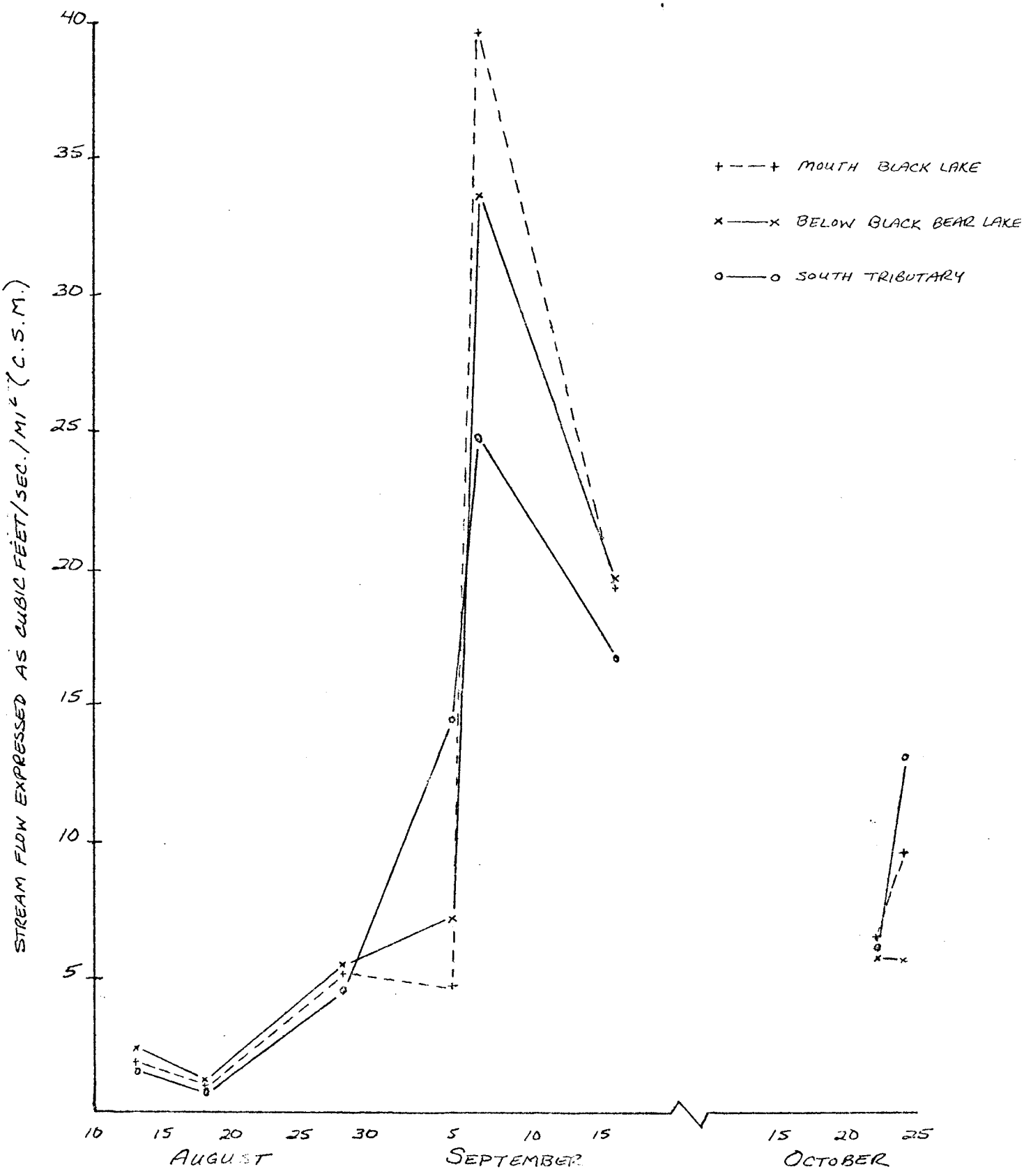


FIGURE 3: Chronological Record of Streamflow Expressed as Yield in Cubic Feet/Sec/Square Mile (C.S.M.)

necessarily representative of an actual hydrograph. Nevertheless, the peak flows shown for September 7 suggest surprisingly high values for the station below Black Lake.

This record is also shown in Figure 3 in terms of flow in yield, cubic feet/sec/square mile for the respective stations and measurements. Several features are suggested:

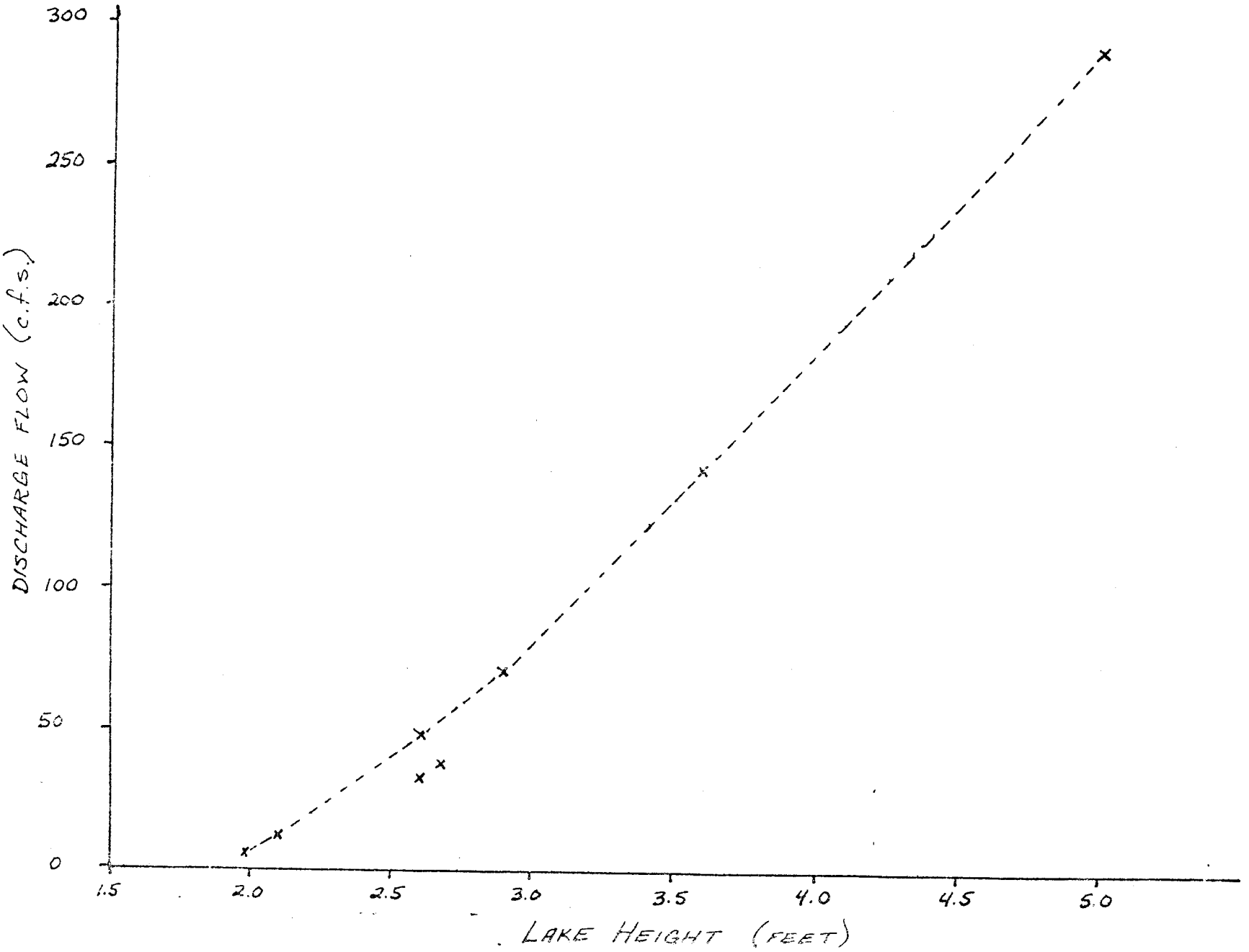
a. Summertime low flows from the Black Bear Lake system have higher yields/square mile than either the South tributary or the large outflows below Black Lake. This was not evident, however, in the October measurements.

b. High flows measured on September 7 suggest that stormflows from Black Bear Lake and Black Lake were comparably larger than flows from the South tributary. Alternatively, it could be that our measurement schedule missed the peak flows from the South tributary by a larger margin than the lake streams. By this argument, the South tributary peak flow, representing a higher CSM yield, had already passed and then receded before measurements were made on September 7. This interpretation is supported by the CSM yields between October 22 and 24, as a result of only a half-inch of rain. It is also supported by the streambed characteristics, which clearly show that the South tributary is subject to periodic torrent flow conditions.

Figure 2 indicates the responsiveness of Black Lake level to rainfall. The two-inch rainfall on August 22 produced over a foot of lake rise, while about three inches of rain during September 5-7 caused the lake to rise about 3-1/2 feet.

The relation of Black Lake level to discharge measured at below the lake mouth is shown in Figure 4. This is probably a stable relationship as long as the log jam below the lake mouth stays in place.

FIGURE 4: Lake Level - Discharge Flow Relationship



3. Continuing lake profile measurements of temperature, conductivity and dissolved oxygen in Black Lake and Black Bear Lake.

This data is shown plotted in Figures 5, 6 and 7. When compared with earlier data shown in Black Bear Aquatic Study - Phase I (December 15, 1980) the following characteristics are evident:

a. Upper Black Bear Lake - Temperature conditions in the lake reached much higher levels in August 1981, but the thermocline at this time was shallower, only about 10-15 feet. The September temperature profile showed a well developed thermocline at 40-50 feet, probably 5 or 10 feet less than in September of 1980. The late October profile for 1981 again showed nearly iso thermal conditions, but at 7.4°C instead of the 6.3°C level of 1980.

Conductivity values contain no surprises: rather low values, which in September show a consistent increase with depth.

Dissolved oxygen levels were similar to those of 1980. The September profile also showed a strong gradient at 40 to 50 feet.

b. Lower Black Bear Lake - Temperature curves show patterns similar to those of the upper lake. The September thermocline is 50-60 feet deep rather than 40-50 feet found in the upper lake. This difference was not found in 1980 measurements.

The conductivity profiles are similar to those in the upper lake.

Dissolved oxygen levels shown for the lower lake again indicate the September thermocline at 50-60 feet (same probe as temperature). This, too, contrasts with a 40-50 foot September thermocline in 1980.

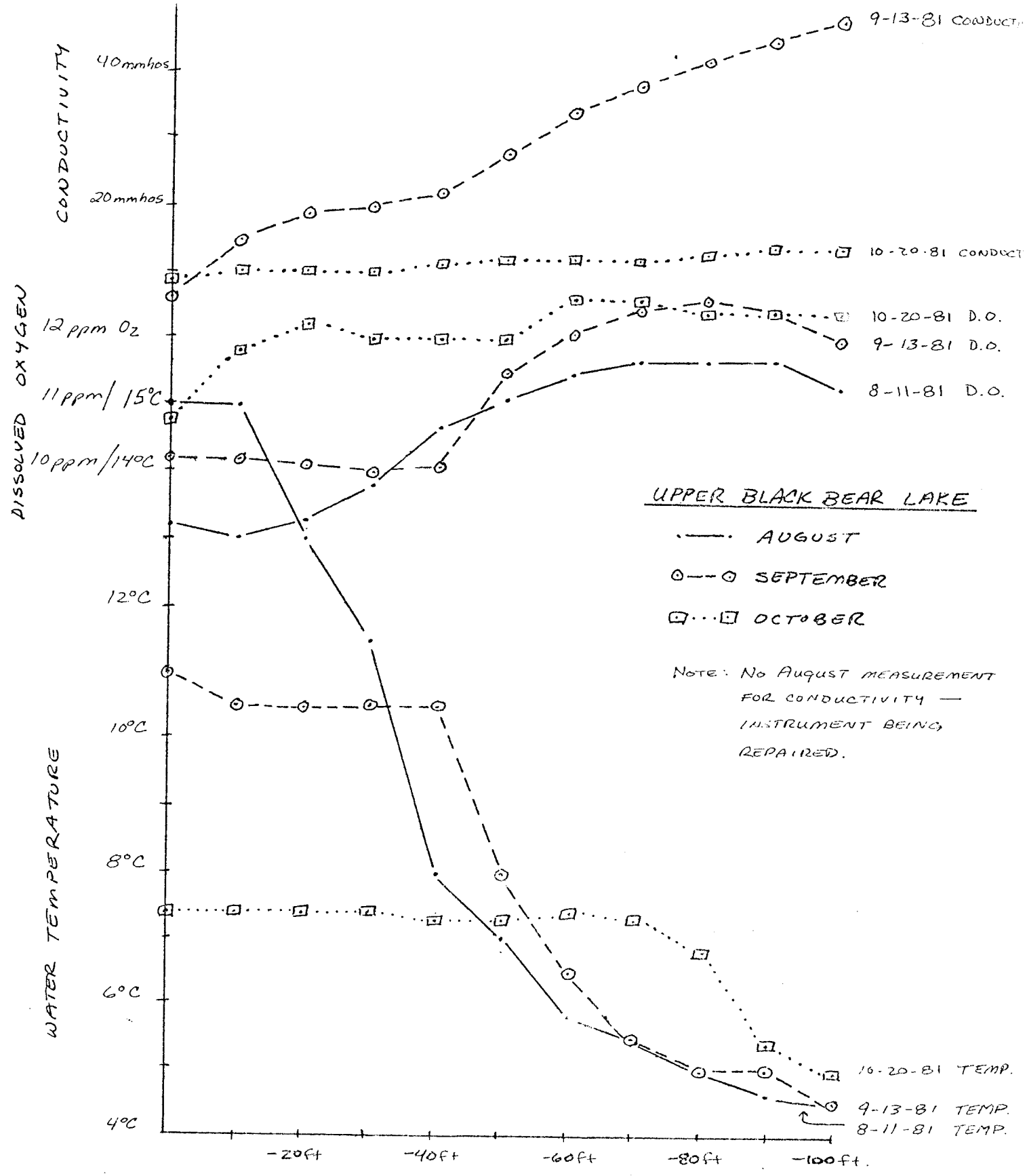


FIGURE 5: Profiles of Conductivity, Dissolved Oxygen and Temperature in Upper Black Bear Lake

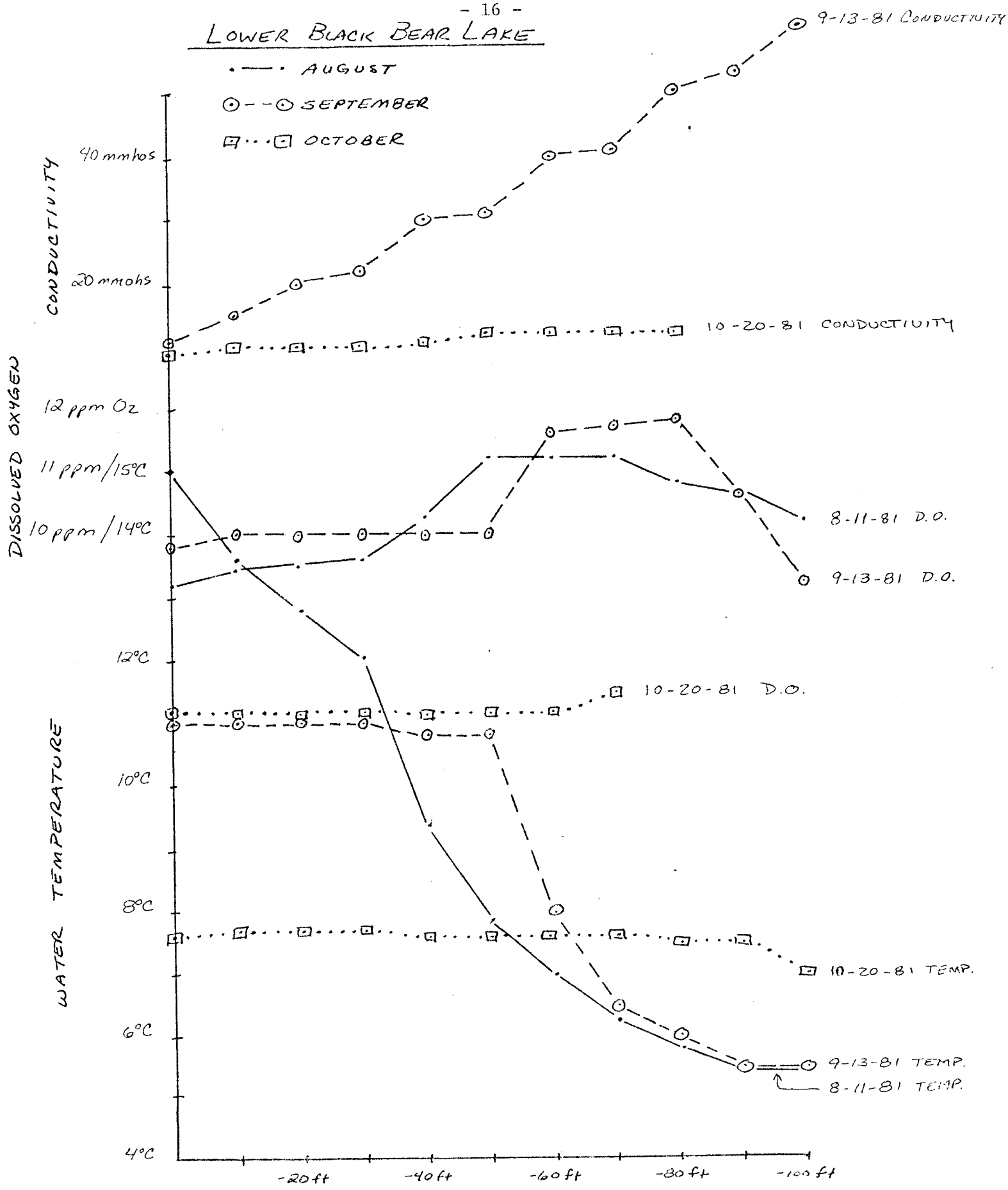


FIGURE 6: Profiles of Conductivity, Dissolved Oxygen and Temperature in Lower Black Bear Lake

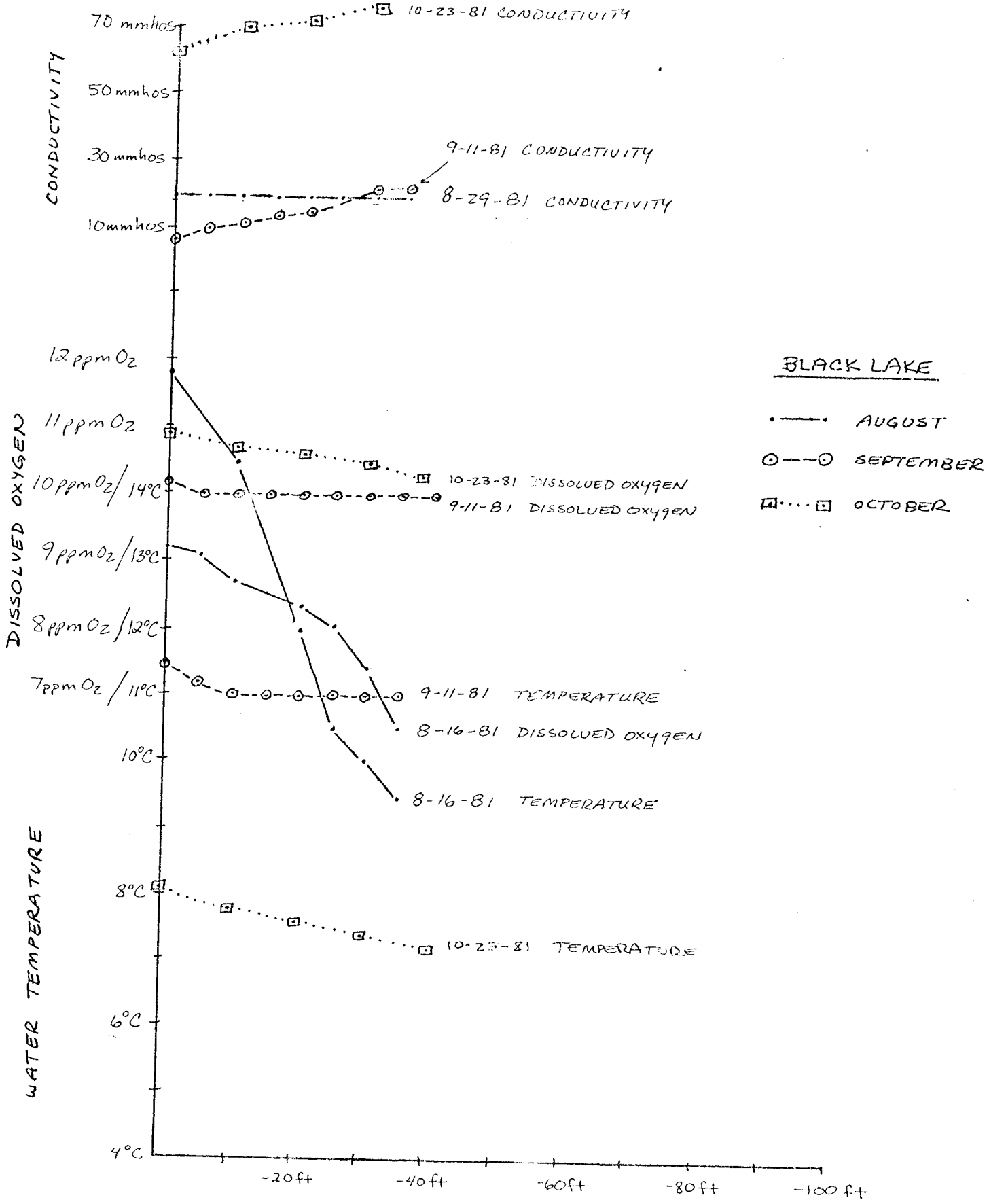


FIGURE 7: Profiles of Conductivity, Dissolved Oxygen and Temperature in Black Lake

c. Black Lake - Here, too, the August 1981 lake temperature profile begins at a high value (15.7°C) and drops at a high rate with depth. This was not nearly as pronounced in August 1980. The September and October profiles are similar to 1980.

The conductivity profiles in August and September are low and without particular significance. Elevated conductivities shown for October may be the result of winds stirring up the lake earlier in the fall. Levels are higher than seen in 1980.

The dissolved oxygen profiles of 1981 show similar curve forms, but somewhat different levels. No particularly noteworthy difference was seen.

4. Continuing water temperature measurements plus installation of a fifth thermograph buried in streambed gravels above Black Lake:

No processed thermograph records are available yet for the summer 1981 field season. Records are being processed at this time.

However, the thermograph records from August 1980 to July 1981 have been examined and are summarized at this time. Daily temperature values for the four stations are shown in Figure 8. Within this plotted record are 185 days of synthesized values for the station at the mouth of Black Bear Creek (MBC). Of these days, 106 occurred November, 1980, to February 15, 1981, and the remainder occurred in spring-summer 1981. Linear regression tests for best fit were made using the other temperature stations and air temperature (Klawock hatchery) as predictors, with the result that the thermograph record for lower Black Lake (LBL) provided the most reasonable predicting tool.

This analysis-synthesis provided a record which was suitable for development of temperature-unit accumulation curves for the four Black Bear Creek stations. This product is shown in Figure 9,

FIGURE 8: Mean Daily Water Temperature for Four Stations on Black Bear Creek, August 1980 through July 1981

BBL: Black Bear Lake Station
UBL: Upper Black Lake Station
LBL: Lower Black Lake Station
MBC: Mouth, Black Bear Creek, near tidewater

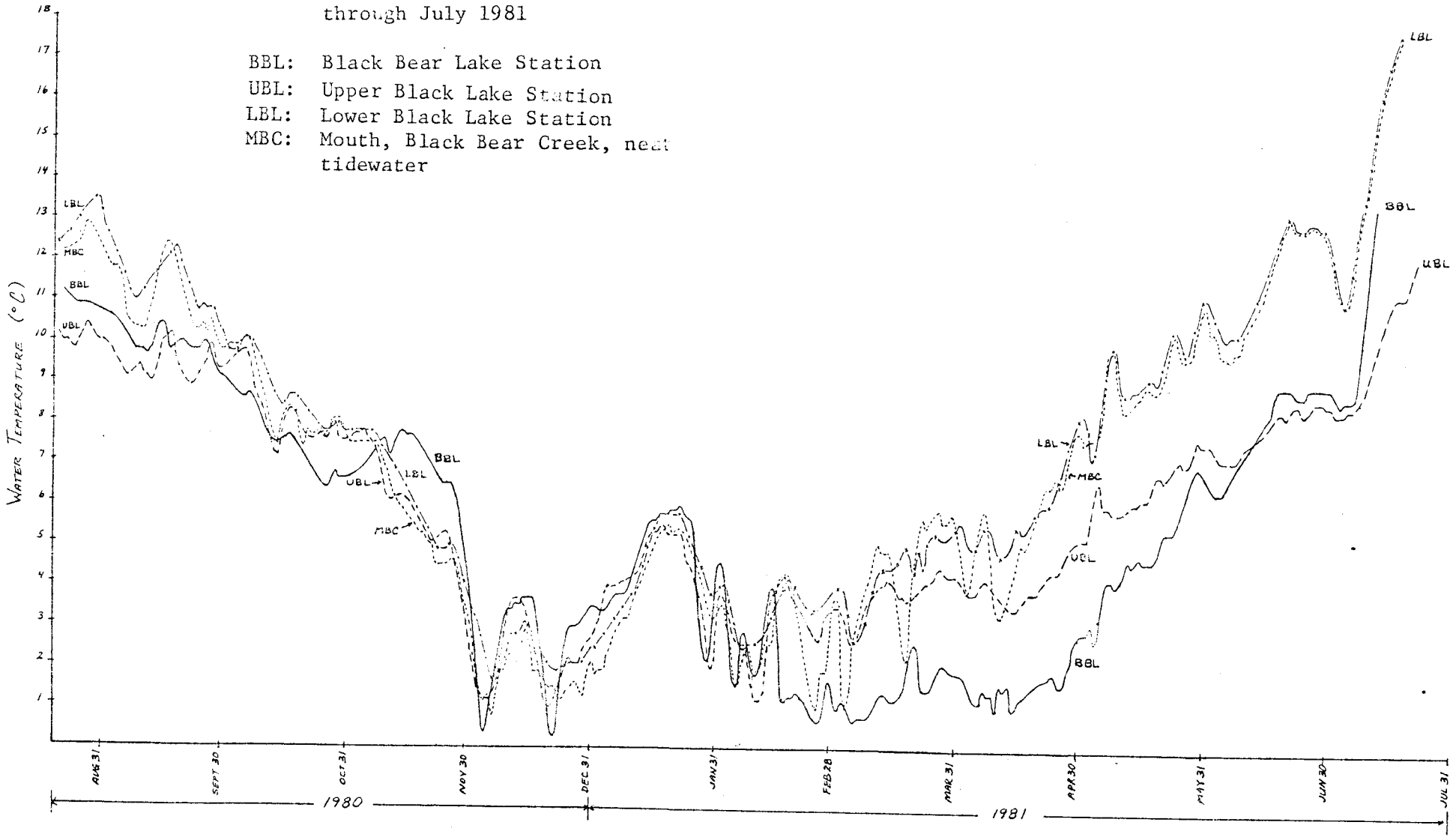
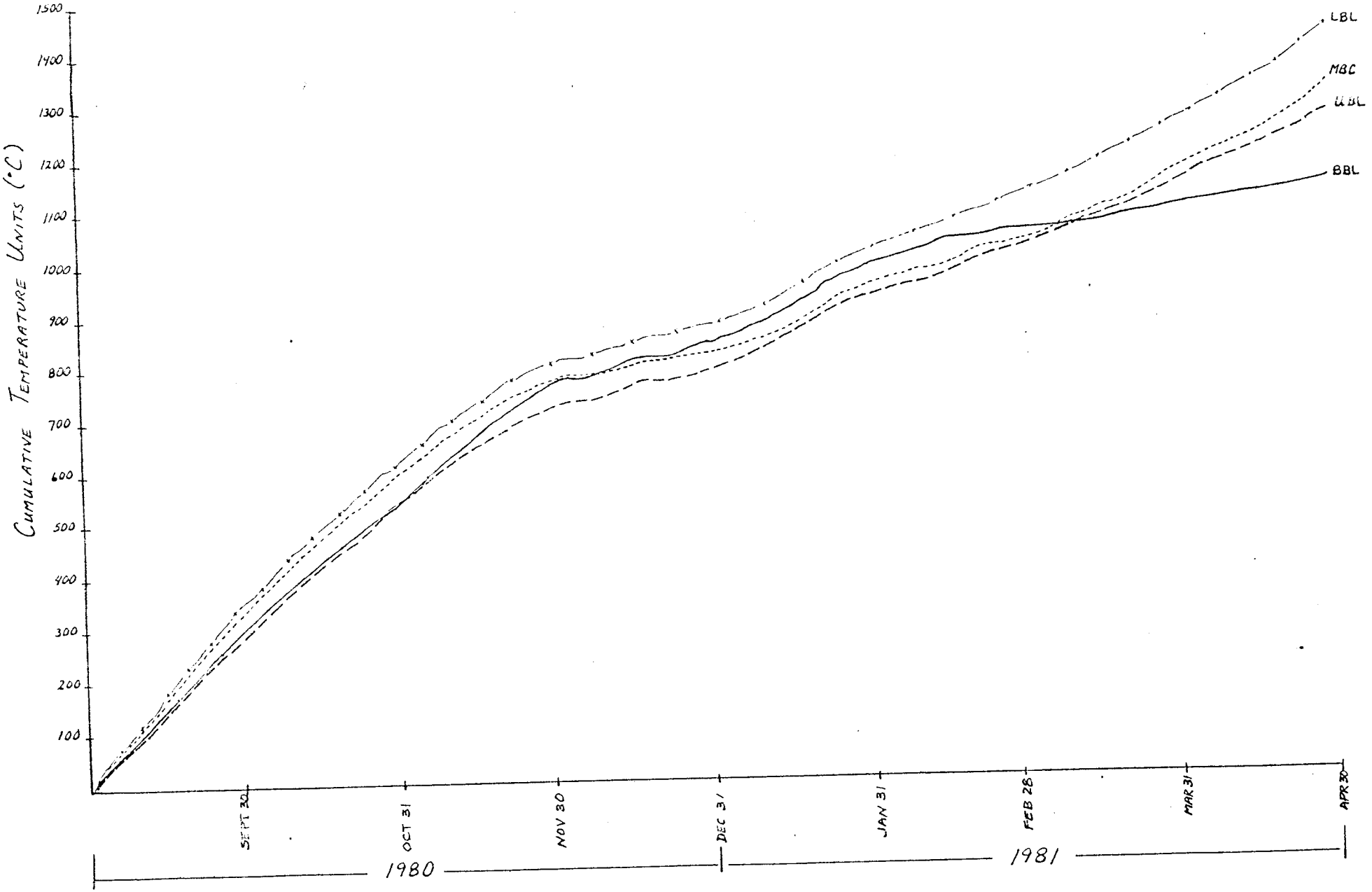


FIGURE 9: Temperature Unit (°C) Accumulation Curve
for the Four Black Bear Creek Stations



and provides a means of evaluating relevant temperature characteristics and differences found within the drainage.

The cumulative temperature record was begun on September 1, 1980, and carried through April, 1981. The September beginning conforms with approximate peak of sockeye spawning in 1981 above Black Lake.

The role of Black Lake in elevating water temperatures is evident from the graph, as is also the slow rate of spring heating observed at the mouth of Black Bear Lake. It is likely that the mouth of Black Bear Creek station (MBC) has a relatively low temperature unit gain in winter as a result of cooling action as the stream flows three miles from Black Lake to tidewater.

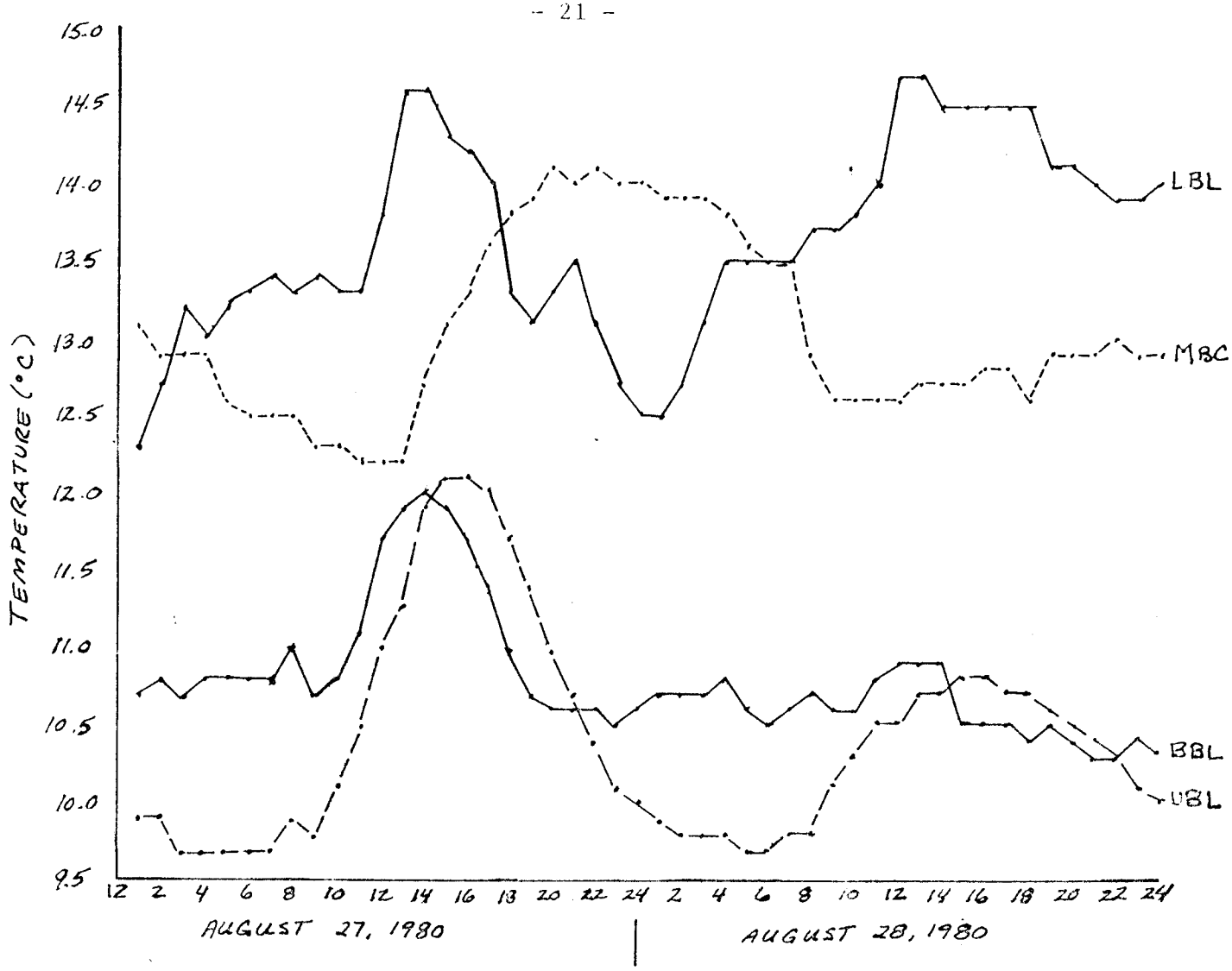
The Klawock hatchery finds that chum salmon eggs require about:

270 - 300 T.U. (°C) to eyed stage
600 T.U. (°C) to hatch
900 T.U. (°C) to emergence

These values are probably low for development of wild eggs-embryo, but they can be used for comparison purposes. Thus, the four stations compare as follows:

	T.U.'s - °C		
	270-300	600	900
Black Bear	Sept 27-30	Nov 7-9	Jan 14-15
Upper Black Lake	Sept 29 to Oct 2	Nov 8-9	Jan 24-25
Lower Black Lake	Sept 23-26	Oct 29-30	Jan 8-9
Mouth, Black Bear Creek	Sept 25-28	Nov 1-2	Jan 21-22

Plottings were also made of hourly temperatures at respective stations for 48-hour periods in summer, fall, winter and spring (Figures 10a, b, c and d). These serve to examine differences in heating characteristics along the drainage system and, hence, to consider how downstream temperatures may result from upstream temperature conditions.



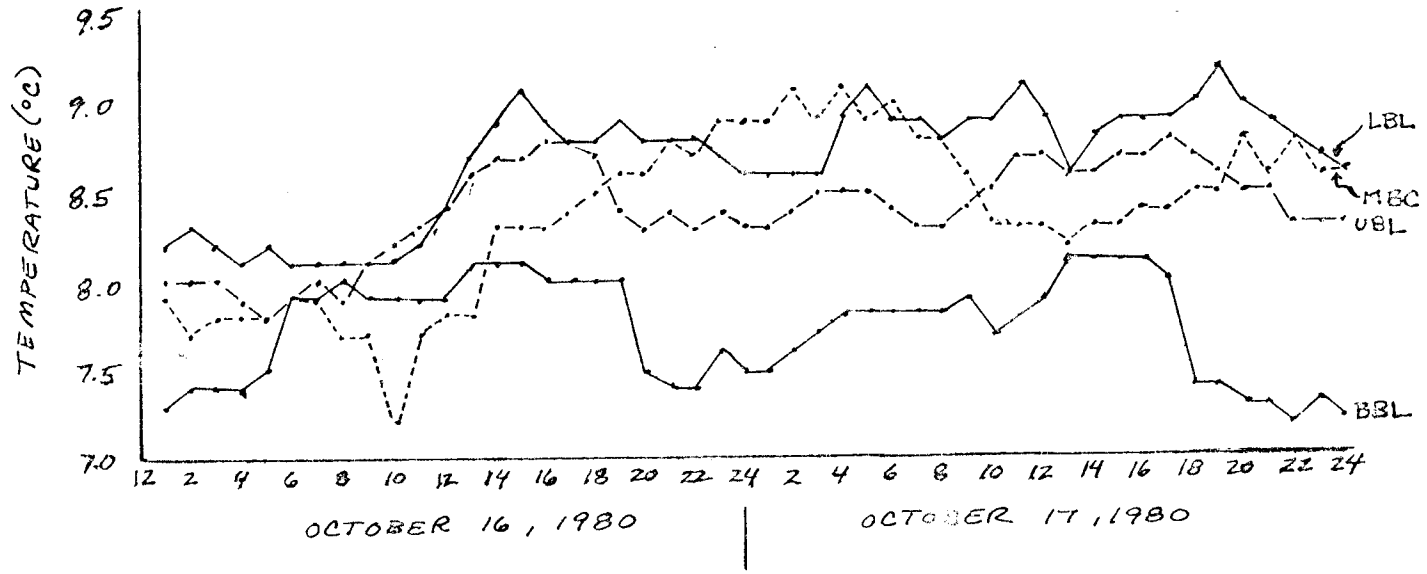


FIGURE 10: Hourly Profiles of Water Temperature Over a 48-Hour Period. (a & b)

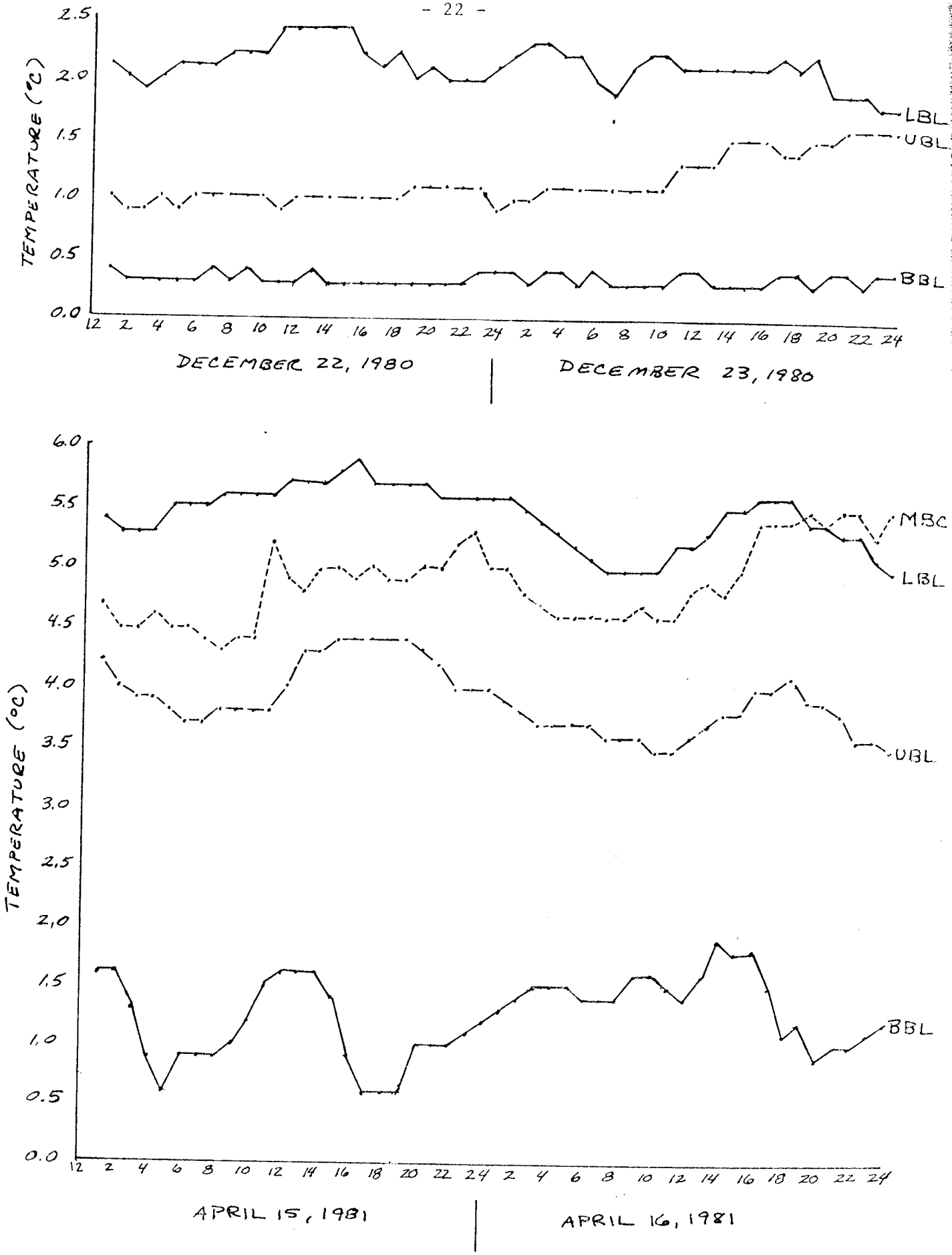


FIGURE 10: Hourly Profiles of Water Temperature Over a 48 Hour Period. (c & d)

During a sunny summer day heating peaks first immediately below the lake situations (about 2 PM). After a delay of about two hours, the peak from Black Bear Lake (BBL) reaches upper Black Lake (UBL), while a delay of six-seven hours is found between the peak at lower Black Lake (LBL) and the resulting peak near the mouth of Black Bear Creek (MBC). The extended peak found on the MBC record suggests that several "waves" of warm water may successively interact to produce an integrated pattern.

The October 16-17 temperature plottings show diurnal fluctuations, but in a much more confusing pattern and involving a temperature range of only about 2°C.

The December 22-23 plottings also involve only about 2°C but even in this plot the thermograph below Black Lake (LBL) shows a significant warming effect produced by the lake, including a mid-day rise on December 22 of about a half degree C. Unfortunately, the thermograph at the mouth of Black Bear Creek was not operating at this time.

The mid-April 1981 plottings show cyclical patterns somewhat similar to but less pronounced than the summer 1980 record. Maximum daily range of temperature at this time is about 1°C. The daily peak temperature at Black Bear Lake (BBL) occurs at 1,200-1,400, while comparable peak in upper Black Lake (UBL) occurs about 1,600-1,800.

The occurrence of spring flows in the stream system below Black Bear Lake undoubtedly has significant effects on water temperatures in the spawning gravels. This will be most true where such upwelling flows in the bed are from deeper sources most likely to be both sustained as well as moderated in temperature (increase in winter; decrease in summer). Information gained from the buried thermograph may indicate the influence and magnitude of such upwelling flows from relatively deep sources.

Upwelling flows resulting from near surface flows through rubble-cobble streambed material also moderates temperatures, but to a lesser degree. These flows are also more prone to recede as low flow water levels drop.

B. Adult Escapement Into the Stream System Above Black Lake

The numbers of adult salmonids returning to spawn was monitored from the end of July to October 24. The method involved two people canoeing and walking identified respective stream sections of the stream system, using a tally counter to record the totals. Averages were then calculated of the two figures. The results, showing counts for respective species by principal spawning sections, are given in Tables 2a through 2d.

On August 5, 420 sockeye salmon (Oncorhynchus nerka) were counted in the lower section of the system up to the junction of the two principal forks. The count on August 10 revealed 598 sockeye in the system, of which 405 were in the lower section of the stream below any suitable spawning area. (Suitable gravel for spawning does not occur until 160 feet below the junction of the main channel with the West Branch of the south tributary.) Of the remaining 193 fish, 143 were located in the south tributary and 50 in the Spring Fork of the Black Bear Lake system. These latter fish were found in the lower section of the Spring Fork and, although pairing was evident, no actual spawning was observed at this time. Four chum salmon were observed at the upwelling of the Spring Fork in early August. By August 13, 730 sockeye were in the system, 401 were in schools or nonspawning habitat in the slower flowing section, 239 were in the south tributary, and only 90 were in the Spring Fork. By August 18, 1,022 sockeye were counted above Black Lake. Of these, 651 were still in schools in the lower section, 283 were in the South Fork, and 82 in the Spring Fork. Spawning activity had commenced at this time. The peak of sockeye spawning was towards the end of August, when 1,281 fish were counted in the system above Black Lake. Of these, 380 were in the South tributary and 543 in the Black Bear Lake system. Allowing for mortality between counts, the total number of sockeye which spawned in the Black Bear Lake system was estimated to be in the region of 650. No sockeyes were observed to spawn in the Lake Fork (of the Black Bear Lake system) above the beaver dam. Approximately 15-20% of spawning sockeyes were seen to be 'jacks', or precocious males.

From the beginning of August various schools of pink salmon (Oncorhynchus gorbuscha) had been observed congregating around the mouth of Black Bear Creek, as it enters Black Lake. On August 18, 18 pinks were observed to

TABLE 2a: Numbers of Spawning Sockeye (Oncorhynchus nerka) in the Stream System Above Black Lake

Location	Date	August 5	August 10	August 13	August 18	August 28	September 5	September 16
Mouth of creek to West Fork of South tributary		420	345	309	546	165	42	0
Main creek from West Fork of South tributary to junction with the South tributary		NC	60	92	111	145	71	0
West Fork of the South tributary		NC	10	34	59	43	36	6
South tributary		NC	133	205	224	337	292	10
BLACK BEAR LAKE SYSTEM	Lake Fork to Beaver Pond	NC	0	0	0	0	19	0
	Beaver Pond on Lake Fork	NC	0	0	0	0	0	0
	Lake Fork above Beaver Pond	NC	0	0	0	0	0	0
	Spring Fork	NC	50	90	82	500	396	7
TOTAL			598	730	1,022	1,218	856	23

TABLE 2b: Numbers of Spawning Pink Salmon (Oncorhynchus gorbuscha) in the Stream System Above Black Lake

Location	Date	August 5	August 10	August 13	August 18	August 28	September 5	September 16
Mouth of creek to West Fork of South tributary		0	0	0	16	629	830	121
Main creek from West Fork of South tributary to junction with the South tributary		0	0	0	0	51	280	156
West Fork of the South tributary		0	0	0	0	14	270	148
South tributary		0	0	0	0	250	1,401	1,752
BLACK BEAR LAKE SYSTEM	Lake Fork to Beaver Pond	0	0	0	0	18	22	127
	Beaver Pond on Lake Fork	0	0	0	0	0	0	24
	Lake Fork above Beaver Pond	0	0	0	0	0	0	468
	Spring Fork	0	0	0	0	206	1,265	1,111
TOTAL					16	1,168	4,059	3,906

TABLE 2c: Numbers of Spawning Chum Salmon (Oncorhynchus keta) in the Stream System Above Black Lake

Location \ Date	August 5	August 10	August 13	August 18	August 28	September 5	September 16
Mouth of creek to West Fork of South tributary	0	0	3	4	0	0	0
Main creek from West Fork of South tributary to junction with the South tributary	0	0	0	0	0	0	0
West Fork of the South tributary	0	0	0	0	0	0	0
South tributary	0	0	0	0	0	0	0
BLACK BEAR LAKE SYSTEM — Lake Fork to Beaver Pond	0	0	0	0	0	0	0
BLACK BEAR LAKE SYSTEM — Beaver Pond on Lake Fork	0	0	0	0	0	0	0
BLACK BEAR LAKE SYSTEM — Lake Fork above Beaver Pond	0	0	0	0	0	0	0
BLACK BEAR LAKE SYSTEM — Spring Fork	4	4	2	0	0	1	1
TOTAL	4	4	5	4	0	1	1

TABLE 2d: Observations of Spawning Coho Salmon (Oncorhynchus kisutch) in the Stream System Above Black Lake

Date / Location	September 5	September 16	October 21	October 22	October 24
Mouth of creek to West Fork of South tributary	0	3	1	5	16
Main creek from West Fork of South tributary to junction with the South tributary	0	0	0	0	0
West Fork of the South tributary	0	0	1	1	2
South tributary	0	0	7	6	20
BLACK BEAR LAKE SYSTEM — Lake Fork to Beaver Pond	0	1	0	0	0
BLACK BEAR LAKE SYSTEM — Beaver Pond on Lake Fork	0	6	1	2	2
BLACK BEAR LAKE SYSTEM — Lake Fork above Beaver Pond	0	0	0	0	0
BLACK BEAR LAKE SYSTEM — Spring Fork	0	1	4	6	2
TOTAL	0	11	14	20	42

have entered the lower section of the creek. Three inches of rain between the 21st and 28th of August caused the stream to rise markedly, whereupon large schools of pinks entered the creek. A count of 1,158 fish was found in the system on August 28th. This run reached its peak by the middle of September when 3,906 pink salmon were counted. Of these fish, 1,960 were spawning in the South tributary and 1,730 in the Black Bear Lake System. The high water in early September had allowed the pinks to migrate over the beaver dams in the Lake Fork of the Black Bear Lake system, and fish were observed in all of the branches up to where the stream gradient starts to markedly rise in the lake outlet channel. No fish were seen in this section of the stream before that date. In the Spring Fork some pinks were observed spawning right up to where upwellings arose from the ground among moss covered rocks. The total number of pink salmon that spawned in the Black Bear Lake system was estimated to be in the region of 2,000.

A few isolated efforts by sockeye to beach spawn were recorded, and three or four pinks were seen attempting to spawn in an inlet stream in the western part of Black Lake.

By the middle of September a number of early coho (Oncorhynchus kisutch) had appeared and 11 were found in the system above Black Lake. Six were seen in the beaver pond on the Lake Fork. Two counts of coho in the third week of October located a maximum of 42 fish in the system above Black Lake. A higher percentage of these fish were in the South tributary. It is likely that coho will continue to enter the system well into winter. Coho were seen jumping in Black Lake during the last week of observations. This trend has been observed by ADF&G biologists on the Klawock River-Lake system, where spawners have been observed as late as March 1. While the total coho escapement into Upper Black Bear Creek cannot be estimated from counts made to October 24, an examination of coho escapement counts made on Klawock River (Appendix 1) showing daily numbers through the Klawock River weir and indicating total annual escapements of coho in the last several years ranging around 2,500 to 4,000 fish suggests the view that adult coho escapement into the upper Black Bear Creek system may be in the magnitude of 200 - 1,000 fish. Later analyses of juvenile fish populations, available rearing area, growth rates, etc., may provide some basis to evaluate this speculative figure.

Schools of Dolly Varden (Salvelinus malma) were observed in the stream system above Black Lake, principally in the South tributary. The number in these schools did not exceed 200 and none were observed in spawning coloration. However, Dolly Varden do spawn in the system, as shown by the occurrence of juveniles (discussed later). It is possible that these fish were in the system to feed on salmon eggs.

C. Resident Juvenile Salmonid Populations in Black Lake and Upstream Waters

An estimate was made of numbers and species of the resident juvenile salmon in Black Lake and the stream system above the lake. For population estimates 1/8 and 1/4-inch mesh minnow traps were used, baited with boraxed salmon eggs and a mark-recapture method was employed. In Black Lake, four large, field-fabricated, wire traps were also used. Other possible methods of capture, for example, seine nets and electro-shocking, were thought to be unsuitable due to the large amount of fallen logs and log debris in the stream and the presence of large numbers of migrating fish.

In the lake, an eight-day multiple mark-recapture using the Schumacher and Eschmeyer's estimate was undertaken. A similar method was utilized in the beaver ponds near where the stream enters the lake and at the lower end of the Lake Fork of the Black Bear Lake system over five and three days, respectively. The stream was divided into three homogenous sections and mark-recapture experiments were undertaken over a 24-hour period using a single Peterson estimate in representative 100-meter sections. Fish collected were divided into young of the year (0+) and fingerlings (1+) using length measurements. At the beginning of August the dividing length used was 55 mm and this was increased to 65 mm by the middle of September.

Length-weight analysis for the fingerlings were undertaken on samples from the lake, the beaver ponds and the lower section of the stream.

A preliminary examination of the results show the principal rearing areas for juvenile coho in the stream system to be the lower section of the stream below the forks and in the beaver ponds. The lower section of the

stream runs for approximately 0.6 mile before entering Black Lake. Typical velocities in the section are from 0.2 to 1.5 ft/sec and depth up to 6 feet. Most of the fish were located along the margins where undercut banks and small side channels are present and where there is a large amount of overhanging riparian vegetation providing suitable cover for the juvenile fish. The substrate is predominantly sands, silts and organics. The controlled range of velocity provides this section of the stream contains stable rearing habitat in terms of flow and probably accounts for the larger rearing fish populations than in the stream section above the forks. The beaver ponds are also not subject to marked changes in flow and, hence, also provide stable rearing habitat. The ratio of coho fingerlings to fry was higher in the beaver ponds than in the stream.

Population estimates for coho fingerlings (1+) were 504 (95% confidence limits 440-595) in the beaver ponds adjoining the stream as it enters Black Lake and 442 (95% confidence limits 344-615). This corresponds to an average estimate of 372 (95% confidence limits 240-431) in a 100-meter section in the lower part of the stream. For the 980 meters of this entire section, this would correspond to an estimate of 3,646 for the lower part of the stream below the forks. This compares to an estimate of 946 coho fingerlings in the two sets of beaver ponds and, thus, these ponds represent an important part of the coho rearing habitat in the Black Bear Creek system.

The flow regimes of the Lake Fork during the summer has an effect on rearing coho juveniles. When the outlet flow from Black Bear Lake is low, the upwelling at the lower end of the gradient is insufficient to permit continuous flow in all of the channels and, thus, isolated pools are formed which trap fish and which may eventually dry up, resulting in fish mortality. The numbers involved are probably small as this section of the stream does not support large rearing populations but, nevertheless, mortality of juveniles does occur.

Only very small numbers of Dolly Varden (Salvelinus malma) were found in the stream system above Black Lake. The largest population was located in the beaver pond system on the Lake Fork where a population estimate

of 82 (95% confidence limits 74-92) was obtained. These fish were all 1+ fish.

No other species of juvenile salmonid were found at this time in the stream system above Black Lake.

A population estimate of coho fingerlings (1+) in Black Lake gave a figure of 2,628 (95% confidence limits 2,196 to 3,271). The two most productive littoral areas were the extensive shallow areas near the east end of the lake where Black Creek enters and the west corner near the mouth of the lake. Many areas on the north shore of the lake are too steep-sided to constitute extensive littoral areas and, thus, numbers of coho in this area were low. The extensive use of large minnow traps seemed to indicate that the numbers of Dolly Varden (Salvelinus malma) in the lake are low for very few fish were captured. Rod and line and the large minnow traps caught only 4 cutthroat (Salmo clarki). Captures of the two species were not high enough to undertake mark and recapture experiments.

D. Observations of Mammal Populations Above Black Lake

Objectives

To approximate the number of beaver and black bear using the drainage above Black Lake, identifying key habitats; to maintain a log of sightings of beaver and black bear, and to develop a map of the valley bottom above Black Lake showing key use areas.

Approach

Mammal sign (including tracks, den and bedding sites, feeding sites, scats, remnant hair, and actual sightings) was observed and recorded daily. In addition to data collected during fisheries biology work (which was stream and lake-intensive) five traverses of Black Bear Creek valley were undertaken with the sole objective of observing mammal sign. One complete circumambulation of the valley was thus achieved, with more intensive, repeated thrusts into areas heavily used by mammals.

These intensively used areas include the marsh area south of the lower beaver ponds; the area of the forks; a narrow conduit (approximately 60

meters broad) the length of Lake Fork up to the steepening streambed section where spawning ceases; a similar conduit the length of Spring Fork to where it emerges from the ground; a somewhat broader band of use following the South Fork from the outlet of West Branch upstream to where the South Fork turns due south and climbs steeply and spawning ceases in the large-stone streambed. The above areas were traversed at least weekly during the study period.

Specific Observations

Beaver

Beaver sign (shrub and sapling cuttings, tracks, gnawed stumps, peeled sticks, dams, scent mounds, scats, etc.) was found throughout the lower drainage above Black Lake. There is frequent old beaver sign along Black Bear Creek, Lake Fork, Spring Fork, and West Branch. Current, fresh sign is found along Black Bear Creek from the lake up to the forks, and up Lake Fork to a maintained dam and approximately 50 meters beyond. This area shows consistent, current use, with fresh cuttings observed on 30 occasions. Beaver use of the lower ponds is light and intermittent in the presence of people. Eight days of minnow trapping in this area drove the beaver upstream; they returned to the ponds two days after the minnow trapping was concluded.

An adult beaver was seen swimming in the creek just opposite this lower pond area on the morning of August 13 - the only beaver seen all summer.

No small tracks ascribable to juvenile animals were seen, but frequent adult tracks were observed along the stream banks during the times of low water (August 9-20; August 28-September 5) and in the mud along the shores of West Branch and Lake Fork.

Beaver were active throughout the system described above, with most of the approximately 40 runways in the lower creek used frequently enough to inhibit vegetation growth.

Black Bear

From July 31 to August 17, tracks of one small individual prevailed throughout the study area; this was the only animal present until August 18 when a larger black bear moved into the lower creek section back of the lower beaver pond and along the southeast side of Black Lake. This individual's tracks correspond to those of a large black bear seen swimming across the upper lake in March of 1981. These two bears staked out their territories, with the smaller animal ranging widely throughout the forks area, using den sites along Spring Fork and South Fork, and feeding heavily on sockeye and pink salmon, respectively, as the spawns overlapped.

On September 3, tracks of a third bear (sized in between the other two) were seen on the north bank of Black Bear Creek just above the lake, accompanied by the tracks of two cubs with identical-sized tracks.

These five bears, as of September 16, were all feeding heavily on the pink salmon in all three upper branches of Black Bear Creek; on September 16 over 200 fresh, partially-eaten pink salmon carcasses were s[illegible] hauled out on the stream banks, with heavy bear sign abundantly dispersed throughout the upper forks area.

Black Bear Sightings

August 4	Two bears seen on slope above Black Bear Lake outlet, at approximately 2200' elevation.
August 7	Small bear near forks in spruce tree.
August 18	Large bear, southeast shore of Black Lake.
August 26	Large bear, face-to-face, back of lower beaver pond, in marsh.
August 28	Small bear, West Branch, eating salmon.
September 3	Medium-sized bear, on log in lower Black Bear Creek near lake.
September 12	Small bear, west end of Black Lake, on south side in brush.
September 13	Large bear, Black Creek, 1/2 mile below Black Lake, fishing.

Wolf

Tracks of two individuals were seen on two occasions, indicating the passage of a large animal downstream near the head of the lake on August 13; a smaller animal's tracks were seen in the same area on August 10. There was no other wolf sign encountered anywhere in the study area at any other time, nor were there discovered any well-developed game trails of the sort wolves frequent.

Mustelids - Mink and Marten

Mink tracks were commonly seen along the creek banks in the mud on every trip upstream. This sign extended up all three forks, corresponding roughly with spawning activity, and seemed to be heaviest in the lower stretches of Black Bear Creek where coho fry rearing habitat is best.

Marten sign was seen less abundantly than was mink, but occurred more diffusely throughout the upper valley, extending up South Fork valley to at least the lower falls; up Spring Fork and Lake Fork sign is less visible, with no sign seen in the dense brush and blow-down area at the base of the ridge north of the upper Lake Fork section. One marten was seen on September 2 in the deep woods east of the falls on South Fork.

These observations are ongoing. Conclusions, population estimates, and a map on dispersion and heavy use areas-key habitat will accompany the final report, as well as details of observations.

IV. FURTHER WORK ANTICIPATED - SPRING 1982

A. Continue thermograph operations until June 1 (?). Pull all records, thermographs at that time.

B. Continue monitoring of lake temperature, conductivity, dissolved oxygen profiles. Measure in winter 1981-82 and in spring 1982.

C. Perform outmigrant work to determine smolt and fry migration from the stream system.

D. Develop estimate of the rainbow population in Black Bear Lake, and identification of their areas of spawning.

E. Complete length-weight analysis of juvenile coho fingerlings to compare growth conditions in Black Lake, the beaver ponds and the lower section of the stream system.

F. Complete stomach analysis of juvenile coho to ascertain principal food items in the various areas of the stream system.

G. Supplement present map information describing the streambed, stream bank characteristics, streamside vegetation.

V. TENTATIVE COMMENTS ON POSSIBLE MITIGATION AND PROTECTION MEASURES NEEDED FOR DESIGN-CONSTRUCTION OF HYDROPOWER SYSTEM

The points summarized below have not been researched or considered in detail. They are offered at this time primarily for further discussion or examination.

A. The routing and the design of tailrace waterflow should seek a designed balance between discharged water entering groundwater flow routes and water passing back into natural surface flow routes. This may be possible by routing flow <u>across</u> the valley bottom through an infiltration ditch. The depth, width and water level control within this ditch may be used to adjust

proportions of flow reentering groundwater versus surface flow routes.

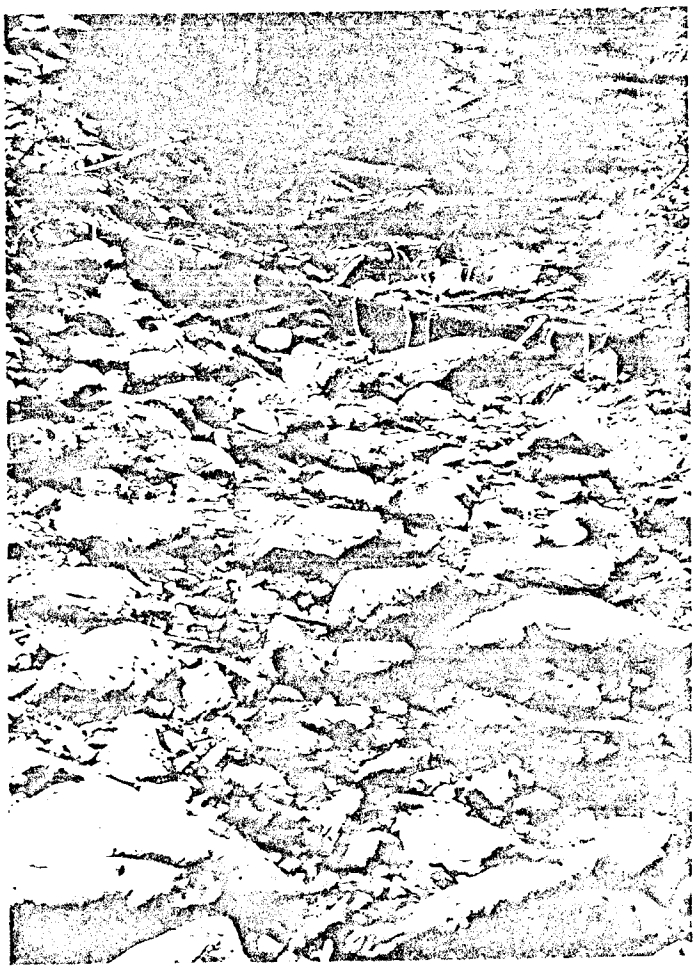
B. When the road access is redesigned, particular care should be taken of the several tributaries entering Black Bear Creek very near to the outlet of Black Lake. It is possible that these tributaries play a significant role in maintaining the level of the lake's outlet and the quality of streambed gravels in the vicinity. Accordingly, the flows of streambed gravels as well as water flows should pass at natural rates into the creek.

C. It is likely that the beaver population above Black Lake will be heavily impacted by the hydro project, road, etc. In time, loss of beaver may reduce coho rearing habitat. An approach to deal with this situation should be developed.

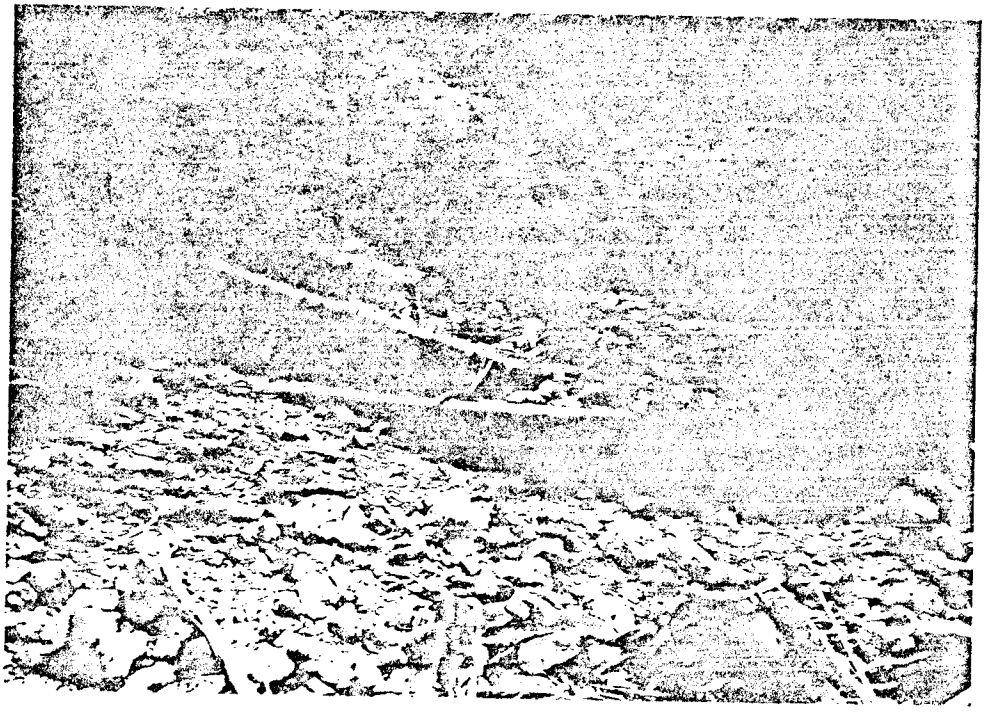
D. The schemes of water volumes released and of associated water temperatures in the tailrace waters may require further adjustment in the hydropower design-operations now that more complete biologic information is becoming available.

PHOTO APPENDIX

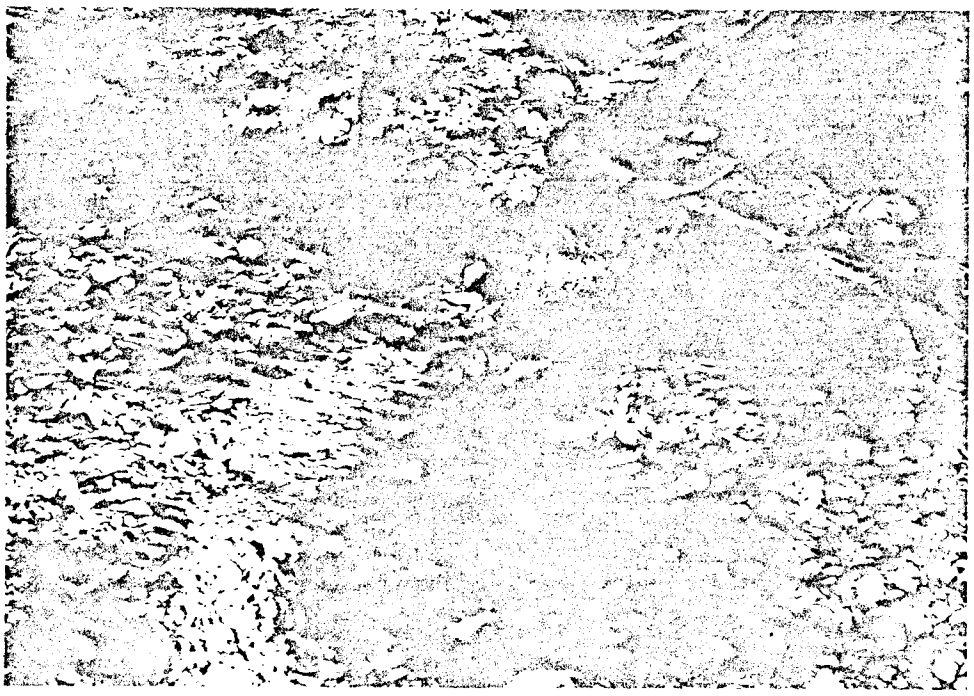
1. Falls from Black Bear Lake in August. 30 yards below this point the stream disappeared underground.



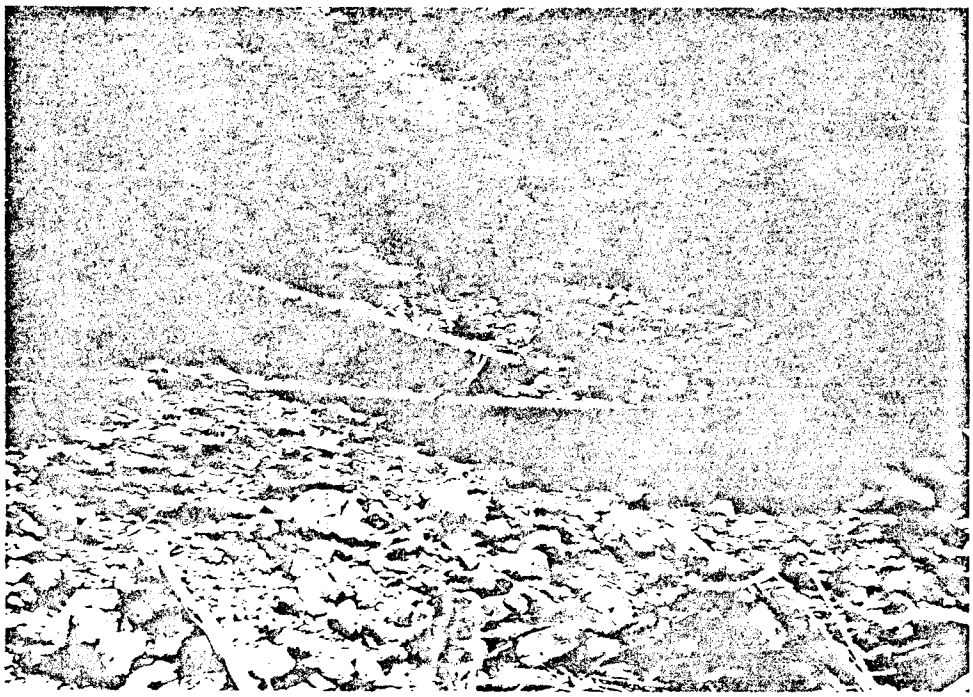
2. Point at which stream from Black Bear Lake disappeared underground.



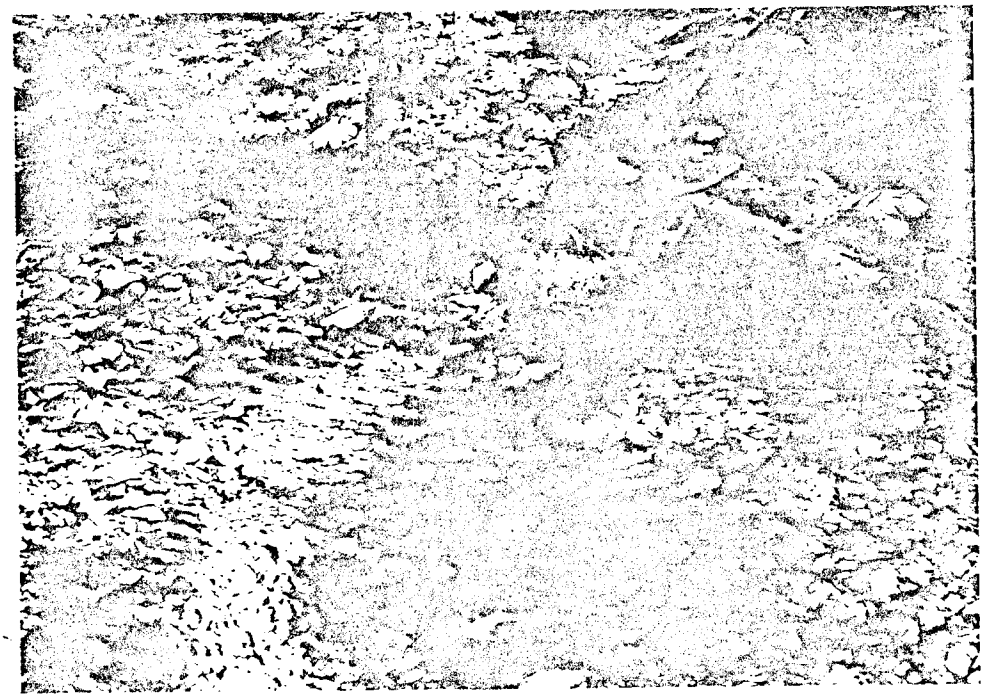
3. Dried up streambed in main channel from Black Bear Lake in August.



4. Reemergence of creek as upwellings at the base of the gradient leading to the falls. Temperature here was little changed from where it went underground upstream near the base of the falls.



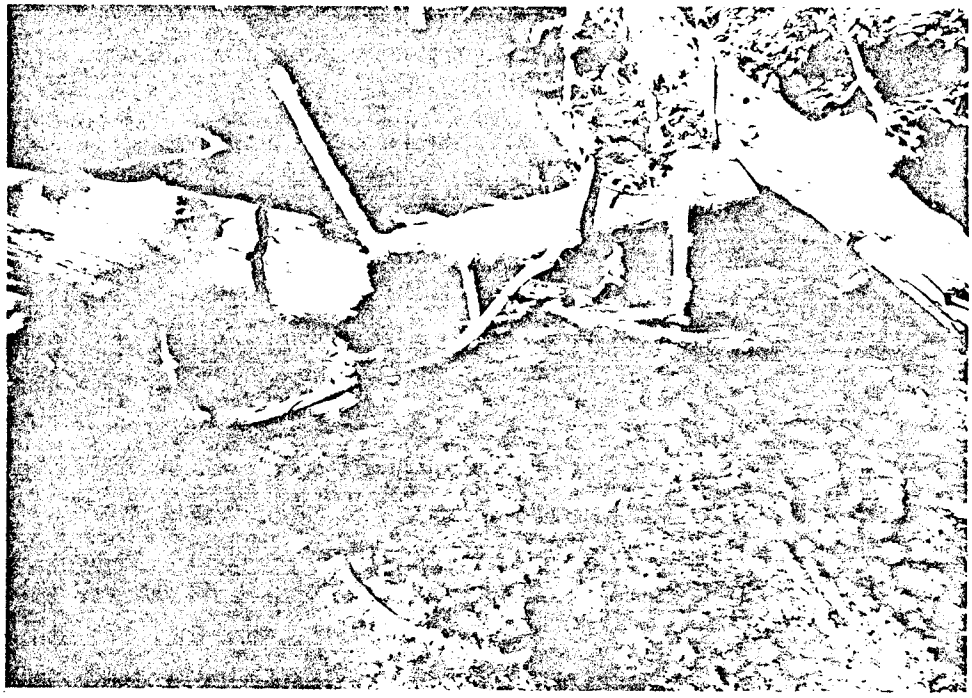
3. Dried up streambed in main channel from Black Bear Lake in August.



4. Reemergence of creek as upwellings at the base of the gradient leading to the falls. Temperature here was little changed from where it went underground upstream near the base of the falls.

5. Moss covered stones at upwellings that constitute the Spring Fork of the Black Bear Lake system. The temperature difference here was 2-1/2°C colder than where it went underground.

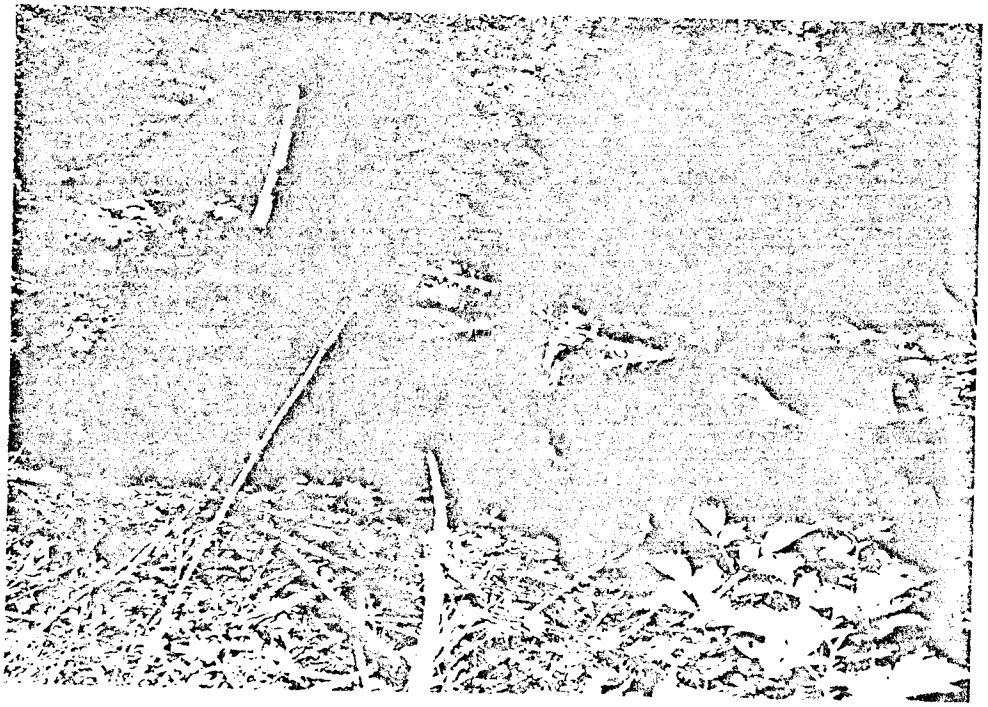
6. Black Bear Lake system to the left at junction with the South tributary (right) to form Black Bear Creek.



7. Spawning gravels near junction of South tributary and Black Bear Lake system. Fallen logs are typical of this section of stream above the two forks where the principal spawning gravels exist. These logs do not form sufficiently large jams as to block the passage of migrating fish.

8. Typical section of stream in the lower reaches of Black Bear Creek below the junction of the two principal forks. It is characteristically slow flowing and with a predominantly sands, silt and organics substrate.

9. Overhanging riparian vegetation and undercut banks are typical of the lower section of Black Bear Creek, providing suitable rearing habitat for coho juvenile salmonids.



10. Beaver dam on Lake Fork causing the formation of beaver ponds which provide rearing habitat for coho and Dolly Varden juvenile salmonids.

KLAWOCK WEIR SHIFT TOTALS

Date	Shift	Chum	Coho	Sockeye	Pink	Jack	Other	Initials
8-8-77		18		36	23			
Aug 9		22		77	47			
10		48		192	82			
11		64		254	100			
12		67	2	359	130			
13		82	3	492	210			
14		96		541	286			
15		130		604	345			
16		153		682	378			
17		165		730	404			
18		177		760	455			
19		182		809	456			
20		183		827	458			
21		185		832	459			
22		196		845	468			
23		201		893	477			
24		214		980	514			
25		222		1056	601			
26		234	4	1146	859			
27		248	8	1184	1001			
28		254	45	1526	2224			
29		264	94	1803	3433			
30		280	123	1964	4508			
31		283	128	2011	4691			
Sept 1		287	139	2166	5408			
2		290	143	2350	6386			
3		297	144	2435	6887			
4		320	159	2474	8100			
5		396	183	2501	10,296			
6		506	353	2634	12,046			
7		651	465	2771	15,790			
8		998	900	2878	25,160			
9		1224	991	2881	27,389			
10		1323	1031	2887	27,955			
11		1504	1174	2889	29,155			
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								

KLAWOCK WEIR COUNT

Date	Chum	Coho	Sockeye	Pink	Comments
9.11.77	1,504	1,174	2,888	29,155	
9.12	1,884	1,411	2,892	33,175	
9.13	2,348	1,664	2,894	33,865	
9.14	2,885	1,983	2,895	34,150	
9.15	3,259	2,114	2,899	34,361	
9.16	3,814	2,174		34,511	
9.17	4,266	2,191		34,618	
9.18	4,733	2,228		34,774	
9.19	5,776	2,319		35,198	Ballot box stuffing
9.20	6,261	2,351		35,297	
9.21	6,588	2,395		36,353	
9.22	8,015	2,718		36,844	
9.23	9,276	3,048		37,112	
9.24	9,892	3,135		37,207	
9.25	10,257	3,218		37,457	
9.26	10,513	3,280		37,612	
9.27	10,690	3,409		37,789	
9.28	10,794	3,425		37,89	
9.29	10,989	3,454		38,023	
9.30	11,198	3,492	2,899	38,306	

KLAWOCK WEIR COUNT

Date	Chum	Coho	Sockeye	Pink	Comments
10.1.77	11,295	3,497	2,899	38,433	
10.2	11,421	3,504		38,672	
10.3	11,627	3,510		38,982	
10.4	11,723	3,513		39,113	
10.5	11,843	3,520		39,377	
10.6	12,012	3,525		39,730	
10.7	12,409	3,646		40,311	
10.8	12,582	3,746		40,414	
10.9	12,612	3,811		40,441	
10.10	12,701	3,885		40,540	
10.11	12,759	3,964	2,899	40,595	

Table 2. Daily Klawock Weir Count, 1978.

Date	Chum	Coho	Sockeye	Pink
8/30	14	470	241	11,685
8/31	28	741	242	21,584
9/1	82	1,150	246	51,226
9/2	117	1,317	246	57,051
9/3	140	1,401	246	58,955
9/4	159	1,407	246	59,366
9/5	202	1,412	246	60,743
9/6	243	1,429	246	62,249
9/7	348	1,482	246	63,875
9/8	420	1,505	246	64,295
9/9	457	1,513	246	64,506
9/10	530	1,520	246	64,799
9/11	683	1,522	246	64,962
9/12	1,584	1,528	246	65,844
9/13	2,658	1,627	246	67,088
9/14	4,695	1,778	246	68,918
9/15	5,674	2,057	246	72,398
9/16	7,020	2,116	246	73,362
9/17	7,359	2,186	246	73,744
9/18	7,527	2,212	246	73,904
9/19	8,097	2,249	246	74,452
9/20	9,195	2,336	246	75,089
9/21	9,323	2,363	246	75,209
9/22	9,351	2,373	246	75,233
9/23	9,526	2,400	246	75,286
9/24	9,560	2,412	246	75,315
9/25	9,599	2,429	246	75,355
9/26	9,725	2,456	246	75,428
9/27	9,808	2,469	246	75,484
9/28	10,173	2,583	246	75,628
9/29	10,229	2,633	246	75,686
9/30	10,399	2,682	246	75,739
10/1	10,498	2,706	246	75,772
10/2	High water closed weir			
10/3	" "	" "		
10/4	10,505	2,711	246	75,931
10/5	10,511	2,715	246	75,977
10/6	10,517	2,720	246	75,996
10/7	10,537	2,734	246	76,027
10/8	10.549	2,758	246	76,051
10/9	10,575	2,783	246	76,096
10/10	10,582	2,791	246	76,118
10/11	10,588	2,796	246	76,137
10/12	10,590	2,800	246	76,240
10/13	High water closed weir			
10/14	" "	" "		

Table 2. Daily Klawock Weir Count, 1978. (continued)

Date	Chum	Coho	Sockeye	Pink
10/15	10,590	2,802	246	76,263
10/16	10,592	2,808	246	76,281
10/17	10,596	2,813	246	76,297
10/18	10,596	2,820	246	76,314
10/19	High water closed weir			
10/20	10,596	2,823	246	76,323
10/21	10,596	2,828	246	76,331
10/22	10,597	2,831	246	76,335

ALASKA DEPARTMENT OF F[illegible]ND GAME
MONTHLY WEIR COUNT

WEIR Klawock River

MONTH August 1979

	RED		COHO		PINK		CHUM				0			
DATE	DAILY	CUMULA-TIVE	DAILY	CUMULA-TIVE	DAILY	CUMULA-TIVE	DAILY	CUMULA-TIVE	TOTAL	GAGE	F			REMARKS
8		0	6	6	8	8	0	0						
9		0	10	16	8	16	0	0						
10	1	1	49	65	56	72	0	0						
11	1	2	82	147	390	462	1	1						
12	1	3	27	174	123	585	1	2						
13	0	3	42	216	130	715	0	2						
14	0	3	45	261	89	804	0	2						
15	1	4	48	309	123	927	0	2						
16	1	5	37	346	103	1030	3	5						
17	0	5	49	395	132	1167	1	6						
18	1	6	25	420	425	1587	0	6						
19														
20														
21														
22														
23	0	6	1	421	12	1599	0	6						
24	0	6	1	422	16	1615	0	6						
25	0	6	3	425	24	1639	0	6						
26	0	6	1	426	15	1654	1	7						
27	0	6	38	464	877	2531	1	8						
28	0	6	23	487	644	3175	1	9						

HIGH WATER TEMPERATURE

ALASKA DEPARTMENT OF FISH AND GAME
MONTHLY WEIR COUNT

MONTH September 1979

WEIR Klawock River

	RED		COHO		PINK		CHUM						
DATE	DAILY	CUMULATIVE	DAILY	CUMULATIVE	DAILY	CUMULATIVE	DAILY	CUMULATIVE	TOTAL	GAGE	0 F		REMARKS
Total Aug. 30		6		487		3175		9	3761				
1	153	159	133	620	7409	10584	16	25	22472				
2	47	206	98	718	3917	14501	8	33	15542				
3	140	346	75	793	1864	16365	5	38	17626				
4	213	559	119	912	3419	19784	7	45	21384				
5	148	707	215	1127	9641	19432	15	60	31410				
6	81	788	98	1225	3720	33 152	17	77	35326				
7	16	804	57	1282	2598	35750	8	85	38005				
8	23	827	32	1314	3014	38764	25	110	41099				
9	13	840	15	1329	5730	44494	70	180	46927				
10	25	865	161	1490	18912	63406	116	296	66141				
11	6	871	79	1569	10158	73564	157	453	76541				
12	67	938	399	1968	32271	105835	961	1414	110239				
13	1	939	22	1990	575	106410	180	1594					
14		939	44	2034	211	106621	10	1604					
15		939	44	2078	123	106744	92	1696					
16		939	21	2099	42	106786	35	1731					
17		939	30	2102	28	106814	114	1845					
18		939	23	2125	60	106874	77	1922					
19	2	941	6	2131	86	106960	12	1934					
20		941	21	2152	27	106987	19	1953					
21			48	2200	120	107007	30	1983					
22			10	2210	7	107014	6	1989					
23			10	2220	8	107022	8	1997					
24			5	2225	44	107 6	4	2001					
25			8	2233	56	107122	32	2033					
26			3	2236	80	107202							
27			9	2245	141	107343	53	2086					
28			32	2277	347	107690	78	2164					
29					109	107799	18	2182					
30													

ALASKA DEPARTMENT OF FISH AND GAME
MONTHLY WEIR COUNT

MONTH October 1979 WEIR Klawock River

	RED		COHO		PINK		CHUM			STEELHEAD				
DATE	DAILY	CUMULA-TIVE	DAILY	CUMULA-TIVE	DAILY	CUMULA-TIVE	DAILY	CUMULA-TIVE	TOTAL	DAILY	ACC.			REMARKS
9/30		941		2277		107799		2182						
10/1			6	2283	93	107892		2182						
2			35	2318	170	108062	38	2220						
3			7 A	2325										
4-7			A	A										
8			7	2332	32	108094	6	2226						
9			16	2348										
10-25	HIGH WATER		HIGH WATER		HIGH WATER									HIGH WATER
10/26							1	2224						HIGH WATER
10/27	through 11/12		HIGH WATER		HIGH WATER									
11/13										2	4			
14			4	2352						1	5			
15			1	2353										WEIR CLOSED
DISCONTINUED WEIR OPERATIONS FOR 1979														

A = Coho were observed jumping from trap to pen to river above pens during high water.

ALASKA DEPARTMENT OF FISH AND GAME
MONTHLY WEIR COUNT

MONTH November 1979

COHO

Trapped Seined in
WEIR Klawock Lake

	SUMMIT		HATCH		NO NAME		INTAKE				0 F			
DATE	DAILY	CUMULATIVE	DAILY	CUMULATIVE	DAILY	CUMULATIVE	DAILY	CUMULATIVE	TOTAL	GAGE				REMARKS
10-31							2	2	2					
11-1							6	8	8					
2							6	14	14					
3														
4														
5	2	2							16					
6														
7														
8							9	23	25					
9	3	5	3	2					31					
10														
11														
12			5	8					36					
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23			3	11	8	8			47					
24			3	14	3				53					
25														
26			2	16					55					
27			3	19	4	15			62					
28			3	21	2	17			67					
29			2	23					69					
30			4	27	3	20			76					

ALASKA DEPARTMENT OF FISH AND GAME
MONTHLY WEIR COUNT

MONTH December 1979 COHO WEIR Trapped and seined in Klawock Lake.

	3 MT		HATCH		NO NAME		INTAKE							
DATE	DAILY	CUMULA-TIVE	DAILY	CUMULA-TIVE	DAILY	CUMULA-TIVE	DAILY	CUMULA-TIVE	TOTAL	GAGE	0 F			REMARKS
Dec		5		23		17		23	76					
11	0		3	26					79					
2			2	28					81					
3			3	31					84					
4					3	20			87					
5			2	33	1	21			90					
6														
7														

ALASKA DEPARTMENT OF FISH AND GAME
MONTHLY WEIR COUNT

MONTH Aug 1980 WEIR Kwiniuk

DATE	RED DAILY	RED CUMULATIVE	COHO DAILY	COHO CUMULATIVE	PINK DAILY	PINK CUMULATIVE	CHUM DAILY	CHUM CUMULATIVE	TOTAL	GAGE	0 F			REMARKS
21	0		0		1306		4		1310					
22	0		16	16	2702	4008	10	14	4038					
23	4	4	8	32	2811	6819	0	14	6861					
24	4	8	39	63	8326	15145	0	14	15230					
25	14	22	48	111	5817	20962	0	14						
26	26	48	68	179	4171	25133	0	14						
29	0		136	315	29918	55051	5	19						
31			101	416	2511	80162	10	29						+ 53,468 Pen. Data
Sept 1			30		1512		21							
2			9		9 1		5							
3			3 3		4 123		5							
4			112		5 104		123							

ALASKA DEPARTMENT OF FISH AND GAME
MONTHLY WEIR REPORT

MONTH Sept 1980

WEIR Klawock

DATE	RED DAILY	RED CUMULATIVE	COHO DAILY	COHO CUMULATIVE	PINK DAILY	PINK CUMULATIVE	CHUM DAILY	CHUM CUMULATIVE	TOTAL	GAGE	O F			REMARKS
		48		416		80162		29						
1	0		30	446	15712	95274	21	50						
2	0		99	545	9224	1448	8	58						
3	0		33	578	4123	8621	5	63						
4	0		112	690	5144	113715	123	186						
5	0	48	122	812	3275	11	81	267						
6			19	831	857	117897	19	286						
7			12	843	262	118159	6	292						
8			23	866	2219	278	58	350						
9		48	40	906	3250	608	154	504						
10	0	48	32	938	15867	140359	180	5814						
11			9	947	3218	149859	253	867						
12			2	949	1875	151734	211	1078						
13			11	960	387	152121	190	1268						
14			7	967	529	152650	136	1404						
15			0	967	856	153506	395	1799						
16			2	969	583	154089	492	2291						
17			11	980	877	154966	359	2650						
18			5	985	644	155610	220	2870						
19			2	987	6613	162223	91	2961						
20			37	1024	41547	203770	124	3085						
21	1	49	23	1047	12782	216712	162	3247						
22			18	1065	9287	225999	233	3480						
23	1	50	78	1143	14793	240792	362	3842	1	1259	3053			
24			4	1147	1634	242426	577	4419						
25			3	1150	981	243407	604	5023						
26	2	52	15	1165	1678	245085	664	5687						
27			6	1171	3386	248471	1253	6940						
28			16	1187	1953	250424	1190	8130						
29			20	1207	2797	253221	1061	9191						
30	1	53	37	1244	2186	255407	68	9259						
Oct 1						100,000	609	9795		3262	5229			
										3255	4140			

Oct 1982 - high water above